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## Automatic Semaphore Block Signals—Illinois Central Railroad.

BY W. J. GILLINGHAM, JR., SIGNAL ENGINEER.

That portion of the Illinois Central Railroad lying between Carbondale and Cairo, known as part of the St. Louis Division, is an extremely busy line. It is the throat so to speak, through which the traffic from the Chicago, Amboy and St. Louis Divisions on the north and that from points south of the Ohio River passes. Until 1896 all this traffic was handled on a single track and the difficulties of operation and of the handling of business soon became so great that a second main track was constructed between the points mentioned.

The major portion of this work is through a country crossed by a spur of the Ozark Mountains, extending diagonally from northwest to southeast through the southern part of Illinois. The heaviest portion of the work is between Bosky Dell and Dongola, the gradients and curves being shown on one of the accompanying diagrams. It is of this section that this article treats in describing the system of block signals now installed and operated between Cobden and Makanda, and which are now being extended from Cobden to Dongola on the south and from Makanda to Bosky Dell on the north, a total distance of 28 miles.

After careful deliberation it was decided to use the standard semaphore and fittings, identical with those used in interlocking practice, except for certain modifications which were made to reduce friction by the introduction of ball bearings.

In 1894 the Illinois Central Railroad had erected in Chicago a semaphore automatic electric signal (which is still in service), for the purpose of experiment and to determine the reliability and efficiency of an exposed semaphore signal electrically operated. The signal is located on the shore of Lake Michigan, where it has been and is now subjected to severe and changeable conditions of weather, and the result of these tests fully justified the decision to adopt this type of signal on the St. Louis Division.

Preliminary to the undertaking of the outside work, plans were prepared showing grades and alignment and the signals were located with a special reference to the grades, bearing in mind the poise of a train in starting after having been stopped at

a signal; the uniform length of blocks being secondary to the location with reference to the grades.

The locations having been determined on the plan, the next step was to make the ground locations with reference to the line of vision taking the grades into consideration.

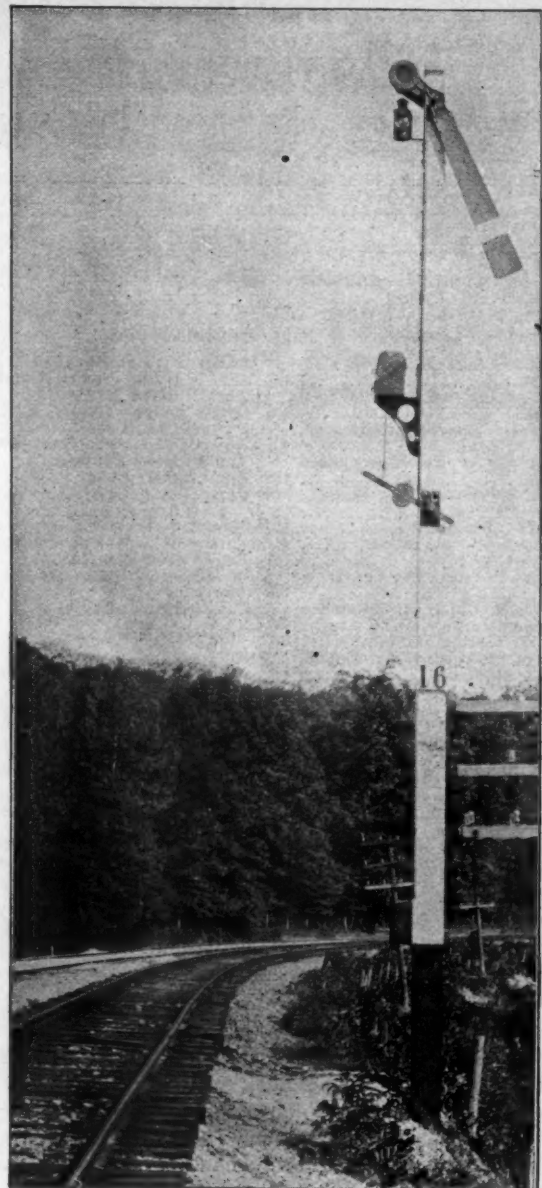
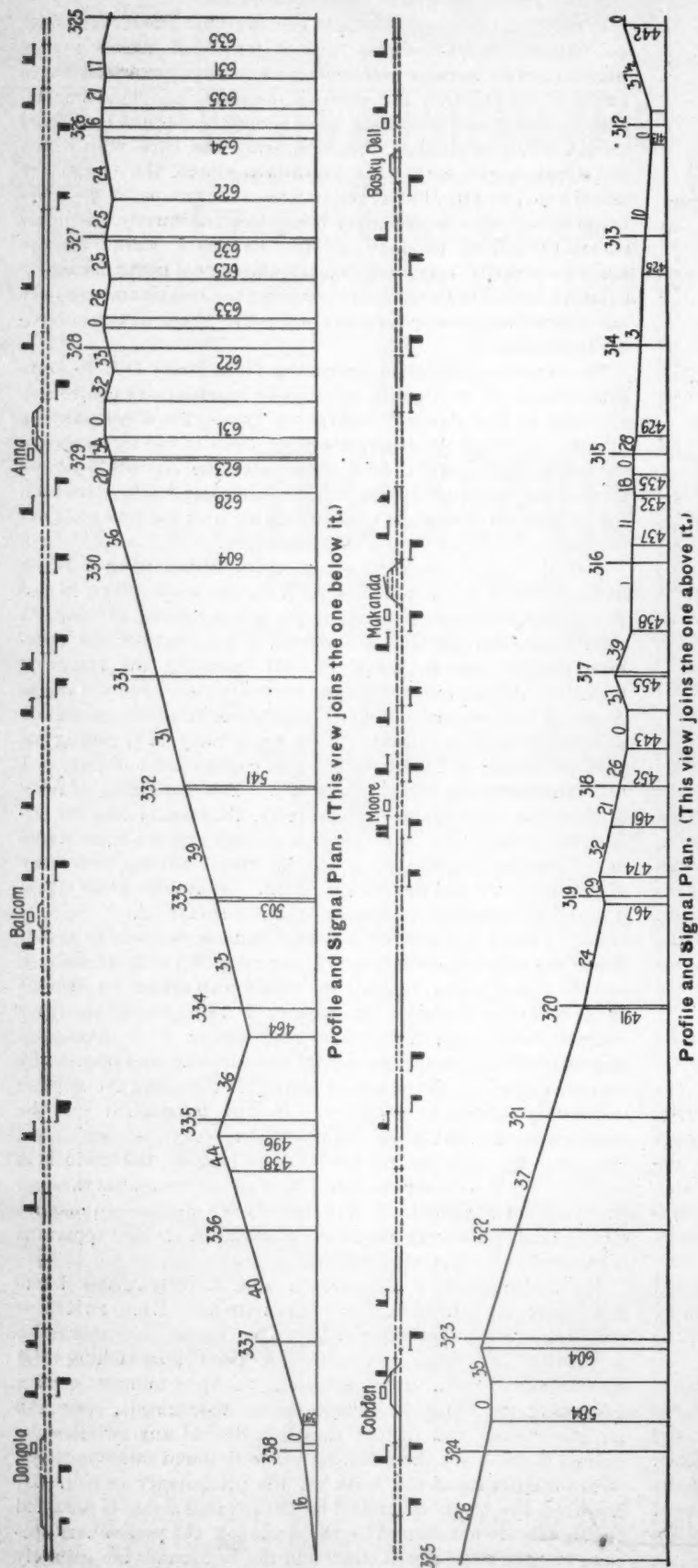
In determining these locations the division officers and signal department co-operated; and it may be of interest to note here that in no instance was there a necessity for variation in excess of 200 feet from the original location, and but four instances were found where the home signals could not be sighted from a sufficient distance, thus indicating the care with which the signals were located. As previously stated, the blocks are not of equal lengths, but at the stations and groups of switches home and advance signals have been placed uniformly, the home signals permitting trains to pull into stations to work when the block in advance is occupied, the advance signal being placed far enough ahead of the switches to permit of the longest train switching without interference or delay when the block next succeeding is occupied.

The complete application extending from Bosky Dell to Dongola consists of 56 signals, electrically operated and controlled, all being of the standard semaphore type. The accompanying diagram, showing the arrangement of circuits and locations between Makanda and Cobden, illustrates the circuits followed throughout the entire application, but the complications are such that a diagram of a single block is shown with the following explanation to insure a clearer understanding.

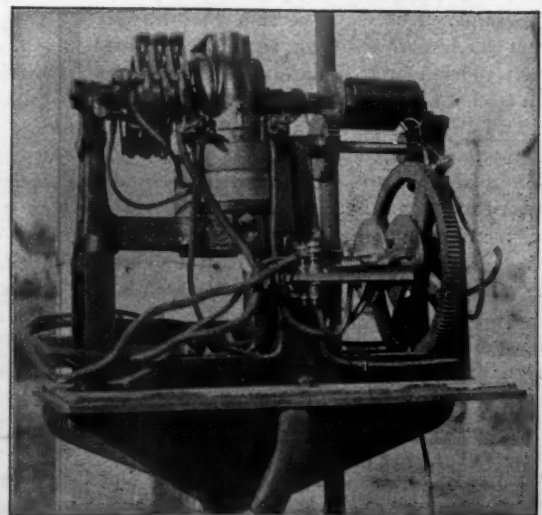
A B, B C and C D are sections of track constituting a block between B and D. R 1, R 2, R 3, R 4, are track relays; M and M 1 are relays directly controlling the motor circuits, B 1 and B 2 are the batteries operating the motors, B 3 is a battery for operating the bells, and B 4 is a battery for operating the relays M and M 1. All the track relays are normally closed and the relays M and M 1 are normally open. The entrance of a train on section A B shunts the track battery from track relay R 1, closing the path for battery B 4 through the back contact point of relay R 1 and thus energizing relays M and M 1. The energizing of relay M closes the front contact on that relay, thus completing the circuit for battery B 1 through this contact and the home signal motor clearing this signal. A similar result obtains with relay M 1, battery B 2 and the distant signal. When the home signal is in the clear position a circuit is closed through the "circuit-closer" battery B 3 and bell magnets, causing the bells to sound. When the train enters section B C the relay R 2 is demagnetized and the distant signal resumes the caution position on account of the breaking of circuit for battery B 2 by opening the front contact of this relay; the train entering section C D demagnetizes relay R 3 and the home signal resumes the stop position by reason of breaking the circuit of battery B 1 through the opening of the contact point on relay R 3. It will be noticed that the home signal is in the stop position and the "circuit-closer" open, but the bells will continue to sound so long as the train is in section C D. This is accomplished by a circuit completed through the back contact point of R 3 battery B 3 and the bell magnet coils. The train having passed out of section C D all apparatus is restored to the normal condition.

Each block section is provided with a distant and home signal and an advance signal at stations. Each switch is provided with a vibrating bell. The signals are normally in caution and stop positions. A train approaching the distant signal will, upon entering the preliminary section (assuming the block in advance to be unoccupied), clear the advance, home and distant signals. Should any switches be located in the block the vibrating bell will sound simultaneously with the entrance of the train on the preliminary section. If, however, the block controlled by the advance signal is occupied the signals are not cleared by the train on the preliminary section, but the home signal clears and the bell sounds immediately upon train passing the distant signal.

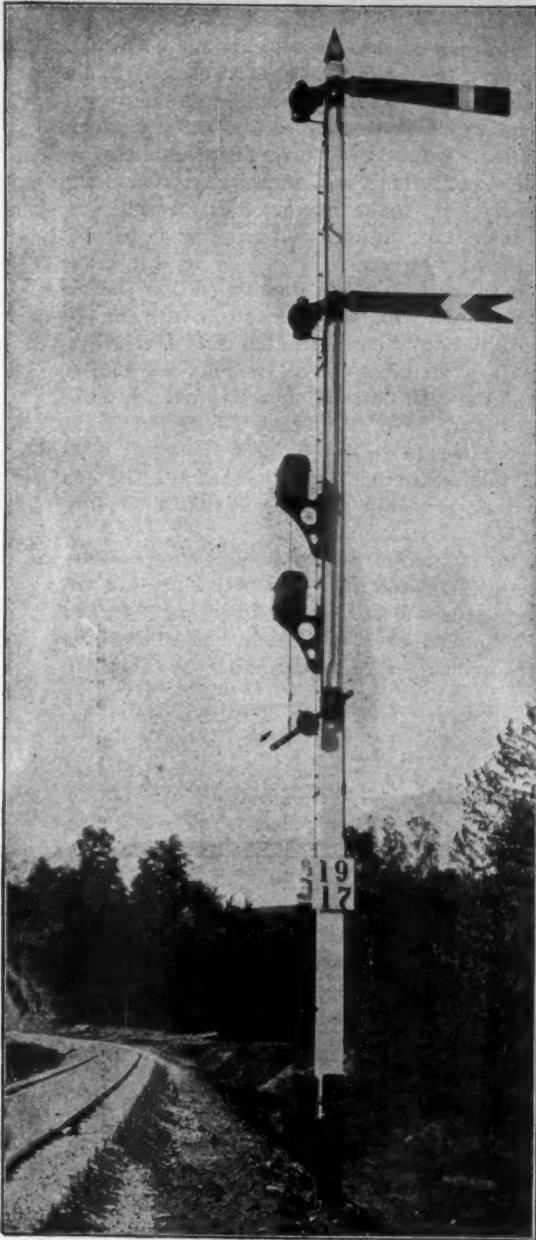
The application of vibrating bells at switches was first made on the Chicago terminal of the Illinois Central Railroad, and while it is true that theoretical objections have been made to



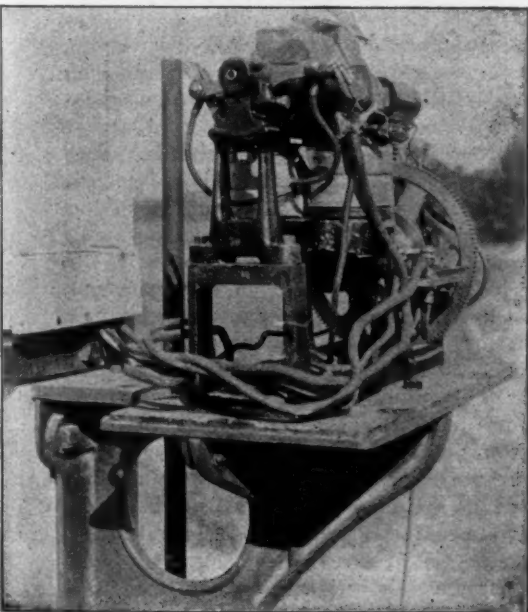
Home Signal "Cleared."



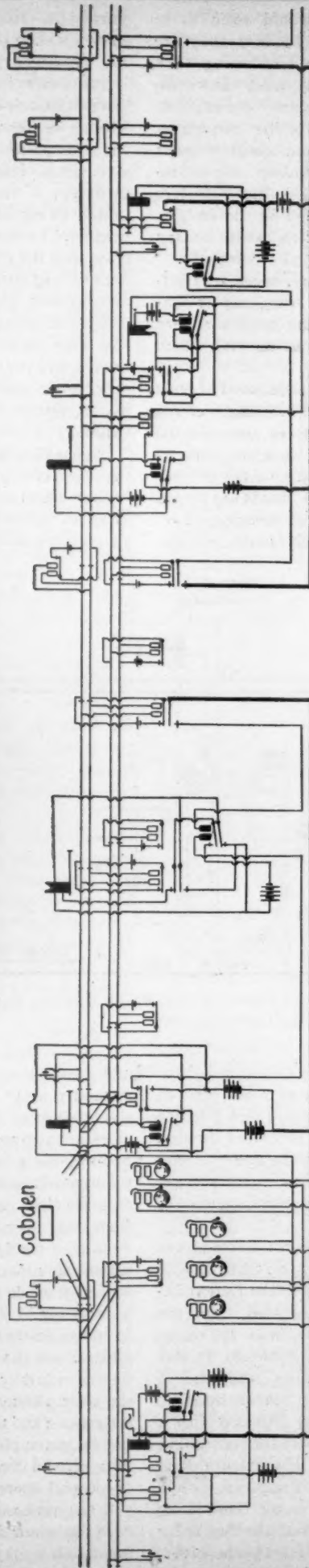
Front View of Motor.



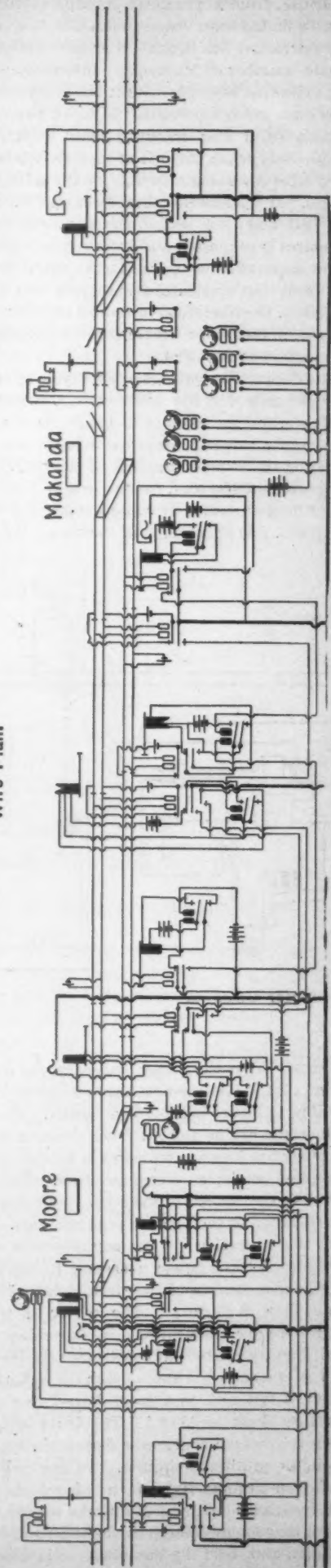
Home and Distant Signal.



Side View of Motor.



Wire Plan.



Wire Plan. (This view joins the one above it.)

AUTOMATIC BLOCK SIGNALS—ILLINOIS CENTRAL R. R.—W. J. GILLINGHAM, JR., Signal Engineer.

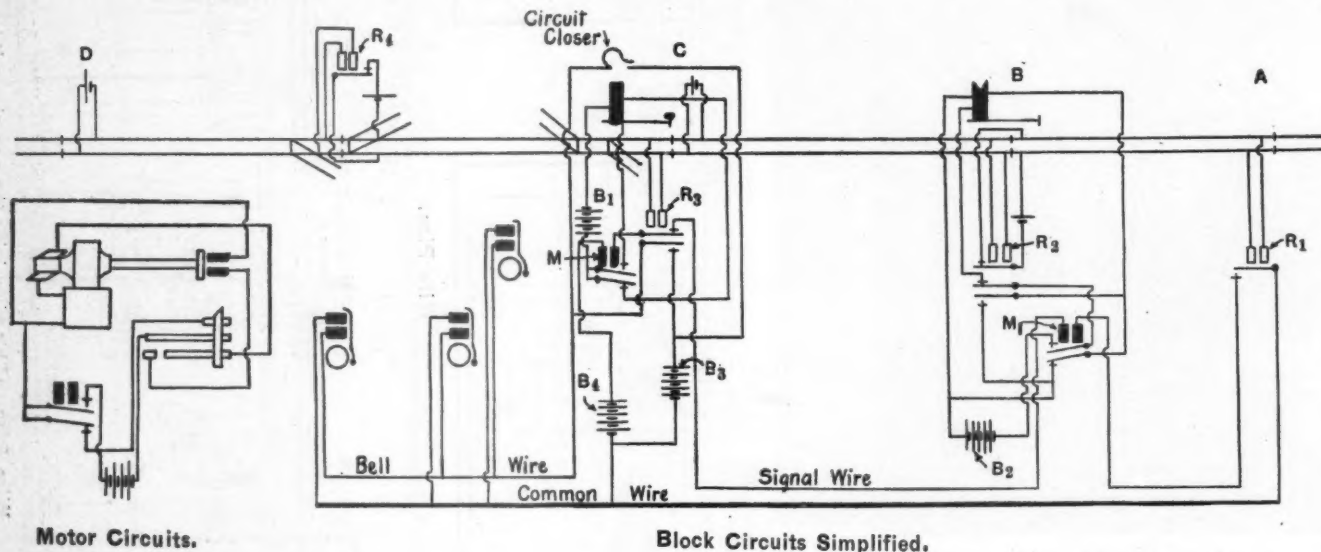
their use, from a practical standpoint they would seem to be more efficient than visual indicators, not only because they are more arrestive but because they give indication or warning to a greater number of trainmen. Instructions governing crews using main-line switches within the block system are very explicit. Trainmen are not permitted to move a switch for the passage of a train from side track to main track or from one main track to the other when the bell at such switch is sounding; nor to proceed after reversing a switch for the siding unless the bell does sound. It is apparent, therefore, that if, in opening the switch, the bell does not sound, the necessity for extra precautionary measures is suggested and trainmen are governed accordingly.

The apparatus for operating the signal directly, necessarily differs from that operating disc signals, and in its simplicity of construction, the likelihood of failure to perform its function is very remote, in fact is no greater than with disc signals with which less battery is required.

The distinctive features of the system are the method of bonding the rails for the track circuit, the use of vibrating bells at switches, and the manner in which the semaphores are operated. Until quite recently the practice has been to bond the joints by fastening the wires to the base of the rails, but this has not proved altogether satisfactory, for the reason that the bonds are forced out or broken, either by contact with the ties or shearing off by the spikes, due to creeping of the rails. So much trouble was ex-

perienced from the latter cause on the approaches to the Cairo bridge that it became necessary to provide some other form of bonding to insure satisfactory results. The method now pursued both on the bridge and St. Louis division work is to bond through the web of rail using two wires in substantially the same manner as applied on electric street railways. This obviates, entirely, the troubles experienced in the other method and reduces the cost of maintenance in the form of replacements.

In considering the application of automatic signals generally, the important question is to determine their reliability and efficiency as an adjunct to the safe and prompt handling of trains. With an inclosed system the apparatus directly controlling the signal is not subjected to changes of atmospheric conditions to



perienced from the latter cause on the approaches to the Cairo bridge that it became necessary to provide some other form of bonding to insure satisfactory results. The method now pursued both on the bridge and St. Louis division work is to bond through the web of rail using two wires in substantially the same manner as applied on electric street railways. This obviates, entirely, the troubles experienced in the other method and reduces the cost of maintenance in the form of replacements.

In the operation of the semaphore a one-sixth horse-power motor is used, the power necessary to operate it varying (according to the resistance of the circuit) from 10 to 16 cells Edison Leland Type S Battery. The motor, as will be seen from the accompanying illustrations, is fastened to the side of the signal pole, directly above the counterweight lever. Attached to this lever is a standard cable  $\frac{1}{4}$  inch in diameter, the other end of which is fastened to a drum keyed to a shaft geared into the armature shaft as 25 to 1. The drum shaft is provided with a worm into which is geared a circuit closing device for controlling the motor and brake circuits. On one end of the armature shaft a soft iron circular disc is fastened, which, in connection with a high resistance coil, acts as a brake to stop the motor, there being lateral movement enough in the shaft to permit of the disc being attracted and held by the brake coils when they are energized. On the base supporting the motor are insulated strips forming a

any great extent, and the question of a normally danger or normally clear system becomes one of preference rather than the superiority of the one over the other. With a semaphore system, however, the conditions are somewhat changed and it becomes not a matter of preference but one of expediency that the signals should be normally at danger. The actual time a signal is in the clear position (for train movements) is very much less than that spent in the danger position; this will vary with volume of traffic. Assuming it to be relatively as one to five the failure of apparatus should be on the side of safety, and the tendency of the signal arm to stick in sleety or snowy weather is certainly in the position at which it is the longest time at rest. It is manifestly true therefore, in contending against such possibilities, that the failure to operate from the stop or danger position is infinitely more desirable than the failure to operate from the clear position. It may be argued that the conditions cited are remote and not likely to occur, but whether this be true or not the principle of such a system being normally at danger is correct, and certainly presents no obstacle in its economical and successful operation.

It has not been the purpose of the writer to describe in this article the minor details of the application, but as a matter of information it may be stated that No. 8 E. B. B. iron wire is used for the line placed on telegraph poles; and that all batteries are

placed underground, those for the track circuit in cast-iron chutes and for the motors and switch bells in cedar tubs specially made for the purpose.

In conclusion it may be stated that the cost of maintenance and operation of these signals, so far as we have been able to judge from our experience up to this time, will be but slightly, if at all, greater than that of the disc system.

#### Car Lighting by Electric Storage Batteries—C., M. & St. P. Ry.

The system of direct car lighting by electricity used by the Chicago, Milwaukee & St. Paul Railway is familiar to our readers, and it is of interest to note the recent introduction of storage batteries on several cars of the trains of that road running between Chicago and Denver.

On Sept. 13 of this year arrangements were made to run through sleeping cars from Chicago to Denver, in connection with the Chicago, Rock Island & Pacific, from Omaha to Denver. To make these sleepers as attractive and comfortable as possible, two of the best twelve section cars were used and fitted with electric storage batteries and lights.

The cars are equipped with 34 50-volt 16-candle power lamps, and four nights are occupied on the road. To meet this extraordinary demand for light the largest capacity battery, with such weight as could be handled, was decided upon.

This battery, the "Selvey" patent, made at Dayton, Ohio, weighs 96 pounds per cell and has a rated capacity of 400 ampere hours. Three sets of 26 cells each were purchased. One set of 26 cells is used under each car. These are carried in four trays all connected in series, and the terminal wires, four in number, three positive and one negative, are carried up into one of the closets where the switches are located. A simple but an ingenious arrangement is provided, by which the lamps can be turned on or off, batteries charged, or discharged, or in case of broken circuit cut out entirely, and the car lighted in the usual manner from the dynamo situated in the baggage car.

When the 26 cells are fully charged they give a combined voltage of 57.2, which is too high for 50-volt lamps to stand economically and two cells are cut off. The terminals from these are led up to the switch box, where they are connected to the three-point switch, No. 3. The first point to the left gives twenty-four cells in series, or 52.8 volts; the second or middle point 25 cells, or 55 volts; the third point to the right gives 26 cells, or 57.2 volts, the arrangement of the circuits being clearly shown in the diagram.

In service the lights are started with the switch on the first point, and as the voltage lowers to 50 from using the lamps, the switch is moved one point at a time until the two extra cells are cut in, and in this way the candle power of the lamps is maintained up to the normal throughout the trip.

In the yard at Western Ave., Chicago, a small storage house has been built and equipped with automatic cutout switches and meters. Also a variable resistance is provided by means of which the extra set of batteries is charged at night from the dynamo that lights the freight buildings situated at this point. The cars arrive every other day, so the batteries are charged during two nights.

A nightly report of the time and number of amperes is kept and returned to the office of the electrician each morning, also a daily report is received from the electric light inspector, and from the porter of the car, so that reliable information is at hand at all times to enable the electrician to keep track of the performance of the batteries.

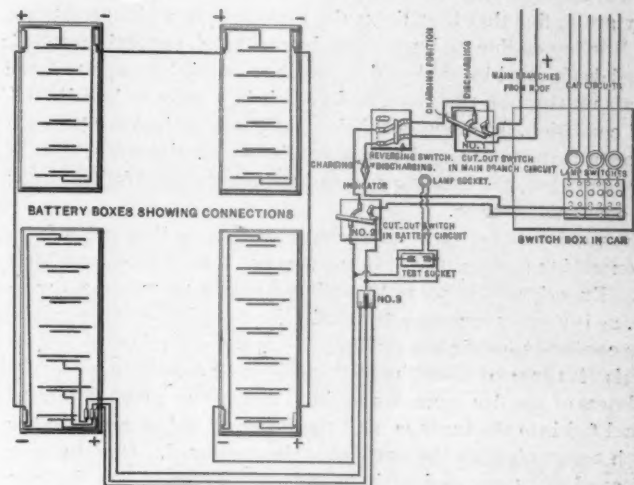
On the return trip the cars come from Omaha to Chicago on the electric-lighted train, having the direct system. If batteries have been run down by the use of an extra amount of light, they can be thrown into circuit with the lamps of this train and may be charged through them. This does not give satisfactory light, however, unless the batteries are about fully discharged, or to 46.8 volts or 1.8 volts per cell. In this case the lamps burn at about their normal candle power. As the cells become charged and the voltage rises the candle power of the lamps decreases. As soon

as this is noticeable the porter throws switch No. 1 to the charging position and takes current for the lamps from the batteries. In this way standard candle power may be had on the lamps at all times.

Owing to the time these cars are on the road and the inexperienced attendance they would receive while en route, it was with a good deal of doubt that they were equipped with storage batteries. The experiment has not been carried far enough to enable the officers to say that it is an entire success, nor can they give the entire cost of repairs and maintenance. However, the cost of charging and attendance at Chicago is stated to be as follows:

Charging, fuel per trip (two nights) .....	\$1.10
Attendance .....	60
Total per trip (four nights) .....	\$1.70

The installation of these batteries and the equipping of the cars was done by the employees of the railroad company at the yards in Chicago, also the designing and manufacture of the various switches and automatic cutouts was done at the shops at



Storage Battery, Car Lighting Circuits.

West Milwaukee under the personal supervision of the electrician, Mr. C. R. Gilman.

The following, which is taken from the instructions issued to the porters of the cars, explains the method of using the storage battery system and the manipulation of the switches in connection with the direct system on the line east of Omaha:

#### Instructions to porters:

After your car has been attached to the Rock Island train at Omaha, and light is required, throw switch No. 1 to discharging position and turn on lamp switches in switch box.

In the morning turn off lamp switches in switch box. The following night, turn then on, and off again in the morning. During the evening and night, turn out as many lights as possible without interfering with the comfort of the passengers.

On the return trip after the car has been attached to C., M. & St. Paul train No. 4, inspector will throw switch No. 1 to charging position. When you arrive at Manilla, or any station where engines are changed, or switching is done, just as lights go out throw switch No. 1 to discharging. That will light your car from the batteries and not leave it in darkness.

As soon as new engine is attached and light is again on the train and your car connected, throw switch No. 1 back to charging position. Be careful to do this every time that engine is exchanged, or your car is cut off train for any purpose.

After the inspector has taken the voltage of the batteries leaving Omaha he will tell you if the voltage is high, and if so leave switch No. 1 on discharging position burning lamps from batteries. Later on when lights begin to grow dim throw switch No. 1 to charging. If, however, they should continue bright, wait until the passengers have retired.

When you get Denver sleeper at Chicago, switch No. 3 will be thrown all the way to the left. The second night (Omaha to Denver) if the lights get a little dim, throw switch No. 3 to center position and light will burn brighter. The third night (Denver to Omaha) when they grow a little dim, throw switch No. 3 all the way to the right and leave it there, this will again make them burn brighter.

We are indebted to Mr. J. N. Barr, Superintendent of Motive Power, and Mr. C. R. Gilman, Electrician of the road, for this information.

### Locomotive "Sparks" for Fuel in Electric Power Stations.

BY EDWARD C. BOYNTON, M. E.

A prominent English railway official, while watching the burning of sparks at one of the power stations, of the New York, New Haven & Hartford Railroad, remarked: "You tell me that this stuff has been already burned in your locomotives, and you are again burning it; now, pray tell me who burns it after you get through with it?"

The fact that the road referred to is using sparks as fuel, to generate electric power, has been mentioned in a general way by several of the technical papers and the daily press, but it will doubtless be of interest to many to know the details of the practice.

Many attempts have been made in the past to burn sparks, but with indifferent success, and vast quantities are daily going to waste. The exact chemical composition of sparks is not now known, though they are believed to be almost wholly carbon. They are so fine that they lie on the grate bars in a compact mass, and it is impossible to burn them by means of natural draft. A forced draft must be used, and it must be powerful enough to force the air up through the mass, and keep it in a more or less distributed condition. In practice this is clearly seen on looking through the open furnace door, when the whole top of the fire is seen in violent motion, the burning sparks jumping up and falling back in a continual shower.

The sparks are fed into the furnace exactly as they come from the extension front of the locomotives, not mixed with anything else. Experience has proved that it is not best to mix them with coal, as it greatly increases the difficulty of firing. They make an exceedingly hot fire, which, however, must be cleaned at intervals of three or four hours. This is necessary because the thickness of the fire increases rapidly, due to the great quantity of fuel fed into the furnace, and the layer of ashes and clinker which accumulate on the grate must be removed. One furnace is cleaned at a time, and with the aid of the blower, the fire can be brought up to the required temperature in a remarkably short time. This is a great advantage, as it enables a fireman to carry an even steam pressure all through the process of cleaning. The extremely fluctuating load due to electric railway work makes the firing much more difficult than it is under ordinary stationary boiler conditions, and in order to produce an even steamline on a recording gauge, a fireman must learn to fire sparks, no matter how good a coal fireman he may be. The weight of sparks required for the evaporation of a given weight of water, as taken from a number of tests, may be said to be about double that of coal.

Several important departures from ordinary boiler practice have been found necessary to insure success in burning sparks, the first of which is in the boiler setting. The boilers used by this company are of the ordinary horizontal flue type, 72 inches in diameter and 19 feet long and contain 130 3-inch tubes. Extending across and resting on top of the brick settings, at right angles to the boilers, are two pairs of heavy channel irons. From these, four heavy iron rods extend down to the sides of each boiler, two on each side near the ends of the boiler. These rods hook into lugs riveted on the sides of the boiler, at the center line. The boilers are thus suspended from four points, and all movement due to expansion or contraction is provided for in this manner.

A so-called "exploded idea" is also brought into successful use in placing the boiler so that the bottom of the shell is 48 inches above the grate bars, while the top of the bridge wall is only 18 inches above them. As a result of this, a very large combustion chamber is secured, the purpose and effect of which is to allow all the gases of combustion to become thoroughly ignited before entering the tubes. That this is of great advantage is shown by the very low temperature of the gases in the smoke flue after leaving the boilers. This temperature averages about 35 degrees above that of the steam. The furnace is six feet wide and seven feet long, making 42 square feet of grate

surface. For convenience in cleaning fires, about two feet of the grate, nearest the bridge wall, is arranged to turn over and dump into the ash pit, by means of levers. The type of grate bar used is the well-known "herring-bone," with openings about three-eighth-inch wide.

One of the most interesting details is the peculiar forced draft, because of its bearing on the burning of sparks. This part of the equipment consists of a cast-iron cylinder or pipe about nine inches in diameter and two feet long, bell mouthed at one end. This extends through the boiler front into the ash pit, either between the ash pit doors or through one of the doors. The bell mouth projects outward and in it is a hollow brass ring, seven inches in diameter and nearly elliptical in cross-section. On the inner edge of this ring are 20 small holes  $\frac{1}{8}$  inch in diameter. There is a steam connection to this ring, and when steam is turned on the result is a large number of fine steam jets blowing through the pipe into the ash pit, and drawing with them a large quantity of air through the bell-mouthed opening. The air is considerably heated by the steam after it enters the ash pit, and the sparks get what they require for perfect combustion—oxygen and hydrogen to combine with the carbon they contain. While the boilers are in service the main damper is set so as to be kept nearly closed by the automatic regulator when full steam pressure is on, and it opens very little when the pressure falls. The object of this is to confine the gases and allow them to escape into the chimney very slowly.

A peculiarity about this method of burning sparks, and one that requires the constant attention of the fireman, especially when cleaning a fire, is that, if the steam pressure gets started downward, it is likely to continue going down so far that it is very difficult to restore it again without stopping the engines. This is due chiefly to the fact that the efficiency of the blower decreases rapidly with the falling steam pressure. With careful firing, however, this never occurs. The regular steam pressure carried with light loads is 100 pounds, but 125 pounds is carried at full load. The number of men required to fire a battery of boilers burning sparks is the same as would be required for coal.

The weight of sparks consumed per electrical horse power hour averages six pounds at a cost of about two mills.

This cost refers only to freight charges for loading and hauling its sparks to power stations. The power consumption refers to an ordinary track with no steep grades or sharp curves. The speed is about 30 miles per hour when using the above power. An electric train seating about two hundred persons and weighing 62 tons requires 36 pounds per train mile at a cost of 12 mills. The power developed by the motors is about  $\frac{1}{10}$  horse power hour per ton mile.

### The New Railroad in Alaska.

The Trenton Iron Company has recently taken a contract for a portion of a new railroad which will soon be built in Alaska. The contract is with the Chilkoot Railroad and Transport Company for the construction of a Bleichert aerial wire rope tramway, to have a capacity of 50 tons per day, for the transportation of passengers and freight over the Chilkoot Pass, and the work is now being pushed as rapidly as possible. One carload has already been despatched and others will follow. The company doing this work is an organization of gentlemen connected with the large steamship lines and the Northern Pacific Railroad at Tacoma. Messrs. Dodwell, Carlill & Company, representing steamship lines to China and Japan, also to Alaska, are among the interested parties. Mr. Hugh C. Wallace is President, and Mr. A. McL. Hawks is the Chief Engineer, and is now engaged on the work of construction. The first section, which will be a surface railroad, will extend from tidewater to the mouth of the canyon, a distance of some eight or ten miles; from there on and up through the canyon and over the Pass the Bleichert aerial tramway will be put up, the northern terminus being at the head of the chain of lakes which afford the means of water transportation to the head of the Yukon River. The projectors of this work expect to have it completed this winter, and to be in readiness to receive freight and passengers as soon as the season opens in the spring, when it is estimated that there will be a great rush of miners and their outfits bound for the Klondike gold camps. We are indebted to the officers of the Trenton Iron Company of Trenton, N. J., for this information.

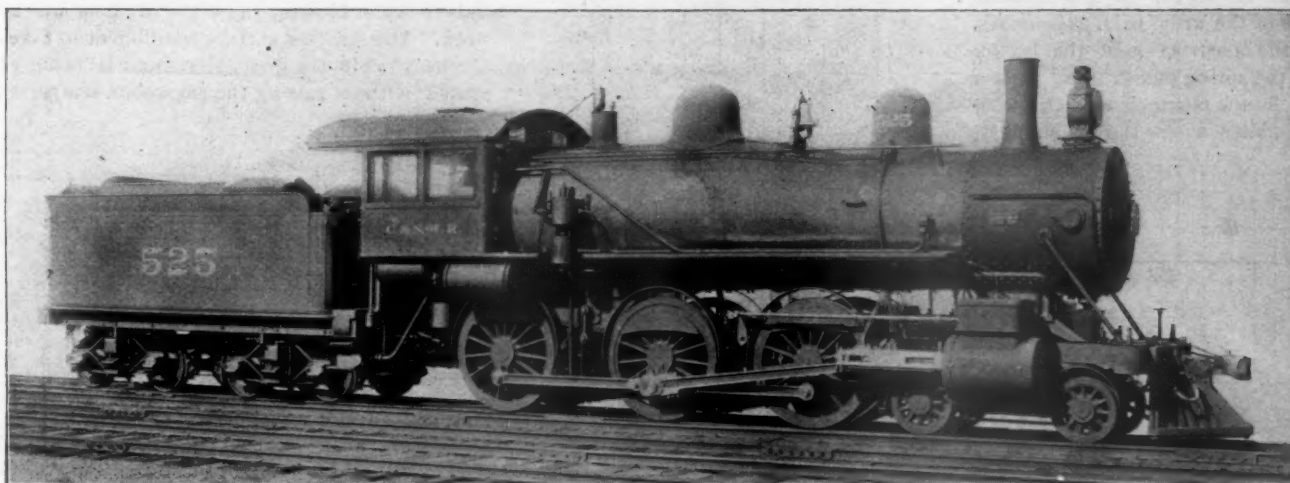
**Ten-Wheel Freight Locomotive—C. & N. W. Ry.**

Several of our contemporaries have presented meager descriptions of a new design for 10-wheel locomotives recently built by the Schenectady Locomotive Works for the Chicago & Northwestern Railway, but as we prefer to publish more than mere pictures we waited for some of the interesting details and for the service records before publishing a description of a design of such merit.

The order was for 10 locomotives, all of which have been finished, and they are doing excellent service. This design does not embody any novel features, but it does comprise excellent combinations which go to make up a good locomotive which will haul heavy loads, and, we believe, will haul them economically. The

keep the engines out of the shop as much as possible it should be noted that the flanges of the cylinder saddle extend beyond the casting itself far enough to receive a short vertical bolt through each rail of the frames outside of the walls of the saddle at the front and back. It is proper to say that cylinder and saddle castings would not fail so often if such precautions were generally taken.

The guides are of the four bar style, which is unusual in 10-wheel engines. The links have a short radius, and the rocker and links are back of the driving wheels, which requires a long valve stem. This is made of heavy pipe, hollow and with the ends welded in. This plan gives short and straight eccentric blades which are to be desired and are much better than the long, springy, crooked ones that were formerly so often used on engines of this

**Ten-Wheel Freight Locomotive—Chicago & Northwestern Railway.**

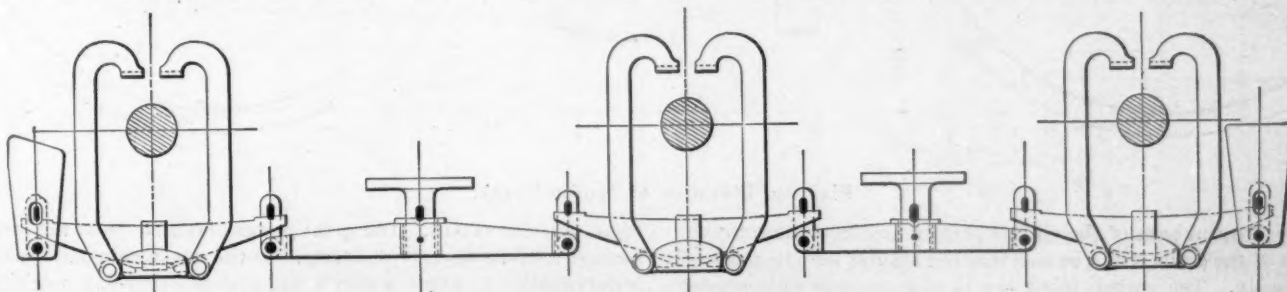
chief feature of the design is high boiler power and strength of parts which should enable the locomotives to avoid the failings of many as to breakdowns on the road. The boilers resembled those of the heavy eight-wheeled passenger engines for this road (illustrated on page 4 of our issue of January of last year) and a comparison will be interesting. The freight engines have 118,000 pounds weight on driving wheels as against 78,000 pounds of the passenger engines, and this necessitated the selection of the ten-wheel type for the new design. The grate is about six inches longer, and while the heating surface of the earlier boiler is 1,903 square feet, that of the new one is 2,311 square feet. The boilers of the freight engines are about two inches large in diameter and 2 feet 6 inches longer.

In order to strengthen the fastenings of the cylinders to the

type. As the link radius is 46 inches long the increase of lead is not excessive.

The driving boxes are extra heavy. The journals are 8½ by 11½ inches. Cast steel is used for the wheel centers, for the foot plates, expansion knees, guide yoke knees, rocker and frame filling blocks, spring saddles and spring seats.

The spring rigging is not new with this design, but it is well worth putting on record. The driving-wheel brake is worthy of special mention because the brake levers are vertical and the lower ends are tied across the engine by the brakebeams, the result to be expected being freedom from swinging and swaying. There are two air-brake reservoirs, one under each running board, and the air pump discharges into one of them, from which the air passes into the other, giving a large main reservoir capacity



Arrangement of Equalizers and Springs.

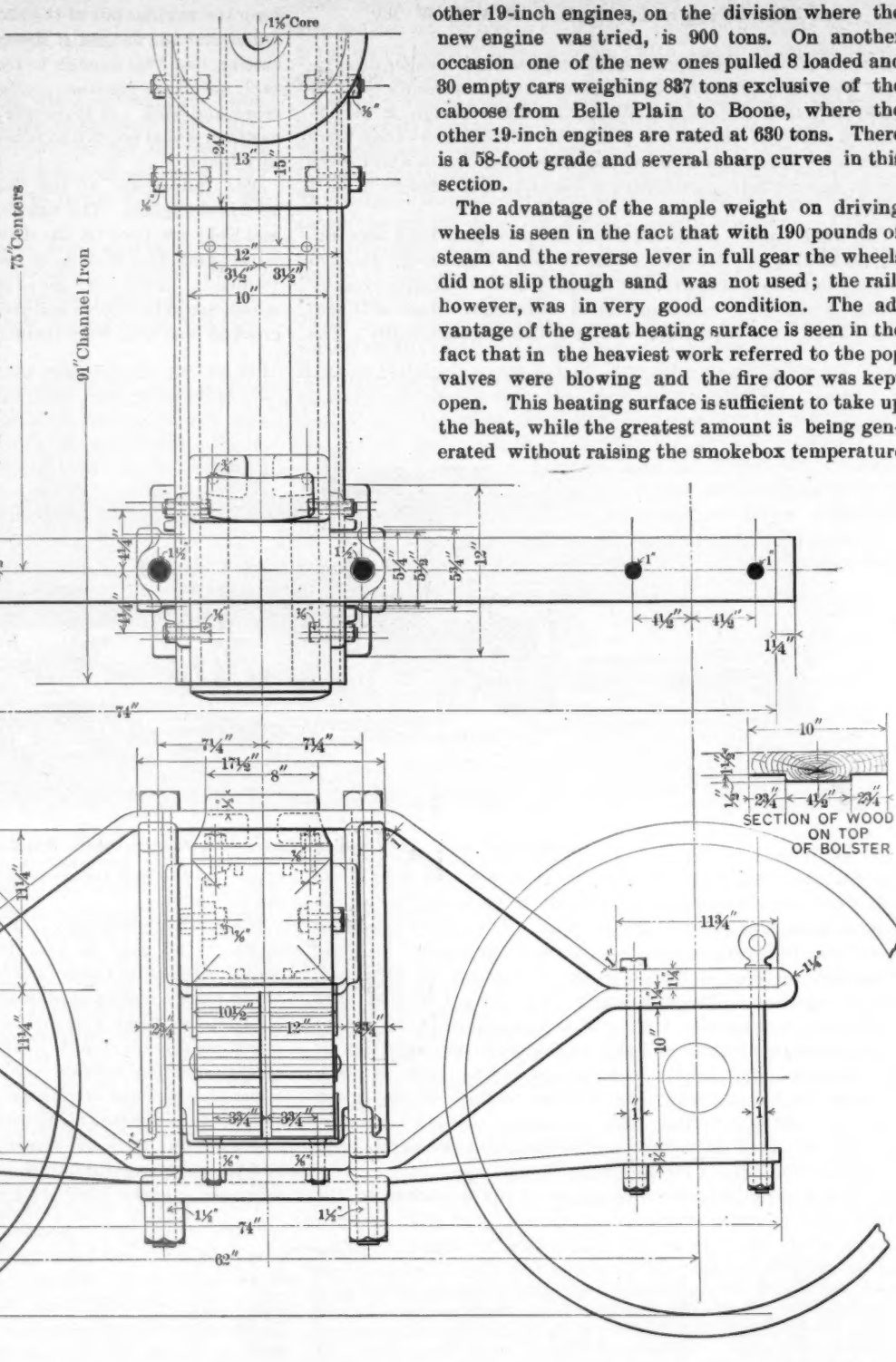
smoke arch a double row of bolts has been used extending all the way around the saddle casting and the joint is further strengthened by the use of a ¼-inch liner inside the smoke arch, which is riveted to the arch and takes the saddle bolts. The two rows of bolts in the back of the arch pass not only through the saddle casting and the smoke arch sheet but also through the smokebox ring which makes a very strong job of this part of the joint. The cylinder saddle is strongly ribbed and flanged in all directions. The frame is, as usual, double at the front end and is made very strong. To show the care which has been taken to

with the additional advantage of being able to secure dry air from the second reservoir.

The drawing of the tender draft rigging shows its construction without extended explanation. It employs the regular car coupler with tail strap, and a car coupler may at any time be used for repairs in case of an emergency. There are no springs in the draft gear. A heavy follower is used and the space in the tail strap is filled by two round-faced blocks, upon which the coupler pivots at that point. A lateral motion of 1½ inches is provided between the coupler and the carry iron on each side;

this is used for freight service only, more space being provided for passenger service. The coupler has only  $\frac{1}{4}$ -inch slack between it and the buffer plate, which is let into the sill; the slack of the follower is somewhat more than this, so that the buffing is taken wholly on the buffer plate in the end sill and the pull is of course taken by the draw casting.

The tender trucks are of special interest and the drawing shows the construction in detail. Attention should be called to the unusual depth of the arch bars,  $22\frac{1}{4}$  inches, and the construction of the bolster and the spring plank. The bolster is of 8-inch channels with  $\frac{7}{8}$  by 10-inch plates across the top and bot-



Plan and Elevation of Tender Truck.

tom. The springs are of the elliptic pattern and from the front elevation of the truck it will be seen that the springs may be removed very easily. The spring plank is a 12-inch channel with wooden filling piece. The design of the truck is an unusually strong one, which compares very favorably with the other features of the engine.

These engines are to be used on the Galena and Iowa divisions running between Chicago and Council Bluffs. The larger number of them will be used on the Iowa division, where the grades are heavier than those of the Galena division. The engines are doing excellent work. They have about 20 per cent. more hauling capacity than the best 19 by 24-inch engines on the road, and while no attempt has been made to ascertain their maximum capacity, they have shown themselves to be able to pull 1,188 tons, of which about 80 per cent. was in empty cars, while the rating of

other 19-inch engines, on the division where the new engine was tried, is 900 tons. On another occasion one of the new ones pulled 8 loaded and 80 empty cars weighing 837 tons exclusive of the caboose from Belle Plain to Boone, where the other 19-inch engines are rated at 630 tons. There is a 58-foot grade and several sharp curves in this section.

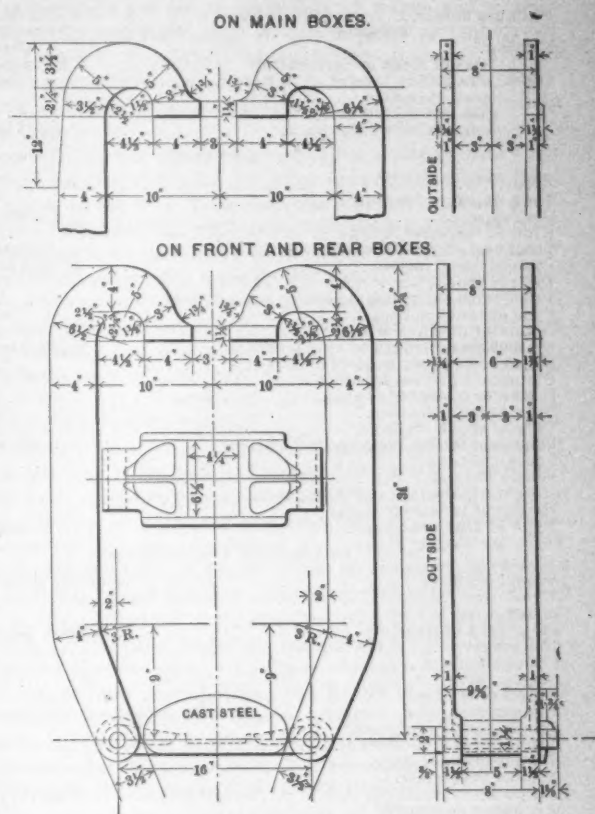
The advantage of the ample weight on driving wheels is seen in the fact that with 190 pounds of steam and the reverse lever in full gear the wheels did not slip though sand was not used; the rail, however, was in very good condition. The advantage of the great heating surface is seen in the fact that in the heaviest work referred to the pop valves were blowing and the fire door was kept open. This heating surface is sufficient to take up the heat, while the greatest amount is being generated without raising the smokebox temperature

to an unusual extent. The great power obtained from the large heating surface is very desirable, but the most valuable feature is the superior economy which it will give in every-day working.

We present the following table giving the leading dimensions:

#### GENERAL.

Wheel base, total of engine.....	25 feet 10 inches
"    "    driving.....	14 feet 10 inches
"    "    total (engine and tender).....	51 feet 8 1/4 inches
Length over all, engine.....	38 feet 4 1/2 inches
"    "    total, engine and tender.....	60 feet 4 1/2 inches
Weight on drivers.....	118,000 pounds
"    "    truck wheels.....	38,000 pounds
"    "    total.....	156,000 pounds
"    "    tender loaded.....	93,500 pounds
Height, center of boiler above rails.....	8 feet 5 inches
"    "    of stack.....	14 feet 9 inches
Heating surface, firebox.....	152.6 square feet
"    "    tubes.....	2,158.3 square feet
"    "    total.....	2,310.9 square feet
Grate area.....	28.65 square feet



### Truck Bolster and Spring Plank.

### Spring Seat and Hangers.

Drivers, diameter.....	.63 inches
" material of centers.....	Cast steel
Truck wheels, diamer .....	30 inches
Journals, driving axle, size.....	3½ inches diameter by 11½ inches
" truck .....	6 in.ches diameter by 10 inches
Main crank pin, size.....	5½ inches diameter by 6 inches

**CYLINDERS.**

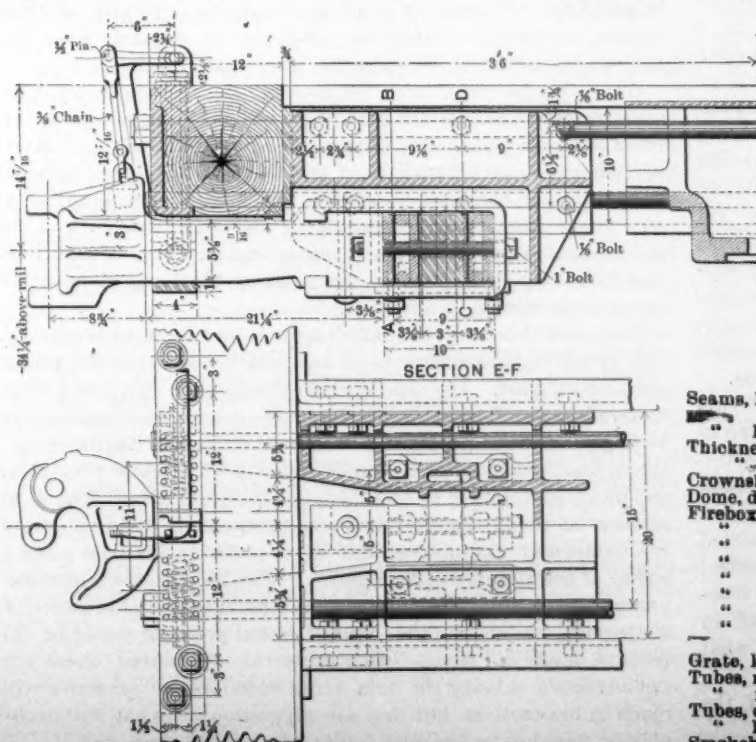
Cylinders, diameter.....	19 inches
Piston stroke.....	26 inches
rod, diameter.....	34 inches
Kind of piston rod packing.....	Cryst. mica
Main rod, length center to center.....	10 feet 6 1/2 inches
Steam ports, length.....	16 inches
“ “ width.....	1 1/2 inches
Exhaust ports, length.....	16 inches
“ “ width.....	3 inches
Bridge, width.....	1 1/2 inches

### VALVES

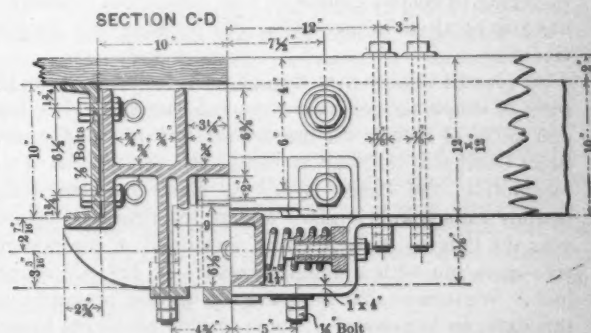
Valves, kind of .....	Allen-American
greatest travel .....	5½ inches
outside lap .....	¾ inch
inside lap or clearance .....	Line and line
lead in full gear .....	⅛ inch blind full gear forward; ⅜ inch blind
full gear back motion with about ⅛ lead at 6-inch cut-off forward mo-	tion

### BOILER.

Boiler, type of.....	Extended wagon top
working steam pressure.....	190 pounds
material in barrel.....	Carbon steel
thickness of material in barrel.....	$\frac{3}{8}$ inch and $\frac{1}{2}$ -inch
diameter of barrel, inside.....	63 inches



### Tender Draft Gear.



Seams, kind of, horizontal..	Butt joint, sextuple riveted, with welt strip	
"	kind of, circumferential..	Inside and outside
Thickness of tube sheets	.....	Double riveted
"	.....	14-inch
Crown-sheet stayed with	.....	36-inch
Dome, diameter	.....	Radial stays 1-inch diameter
Firebox, length	.....	30 inches
"	width	8 feet 6 1/2 inches
"	depth front	3 feet 4 1/2 inches
"	back	79 1/2 inches
"	material	67 1/2 inches
"	thickness of sheets	Carbon steel
"	brick arch	1, 1/2, 1 1/2 inches
"	water space, width; front, 4 1/2 inches to 5 inches under tubes;	Yes
	sides, 4 inches; back, 4 inches	
Grate, kind of	.....	Rocking Railroad Company's style
Tubes, number	.....	295
"	material	Charcoal iron
Tubes, outside diameter	.....	2 inches
"	length over sheets	14 feet 3 inches
Smokebox, diameter	.....	67 1/2 inches
"	length	71 1/2 inches

MISCELLANEOUS PART.

Exhaust nozzle, single or double.....Single

Exhaust nozzle.....	Permanent
diameter.....	4 1/4 inches, 5 inches and 6 1/4 inches
Netting.....	Perforated plate
size of mesh or perforation.....	1 1/4 inches by 1/8 inch
Stack, straight or taper.....	Taper cast iron
least diameter.....	14 inches
greatest diameter.....	16 1/2 inches
height above smokebox.....	3 feet 6 1/2 inches

## TENDER.

Type.....	Swivel
Tank capacity for water.....	4,500 gallons
Coal capacity.....	8 (2,000 pounds) tons
Kind of material in tank.....	Steel
Thickness of tank sheets.....	3/4-inch and 1/2-inch
Type of underframe.....	10-inch steel channels
Type of truck.....	4-wheel
Truck with swinging motion or rigid bolster.....	Rigid
Type of truck spring.....	Double elliptic
Diameter of truck wheels.....	33 inches
Diameter and length of axle journals.....	4 1/2 inches by 8 inches
Distance between centers of journals.....	75 inches
Diameter of wheel fit on axle.....	5 1/2 inches
Diameter of center of axle.....	4 1/4 inches
Type of truck bolster.....	Channel iron
Type of truck transom.....	Channel iron
Length of tender frame over bumpers.....	20 feet 3 1/4 inches
Length of tank.....	19 feet
Width of tank.....	9 feet 2 inches
Height of tank, not including collar.....	4 feet 8 inches
Height of tank over collar.....	5 feet 8 inches
Type of rear drawhead.....	Chicago coupler

## LOCOMOTIVE ATTACHMENTS.

Wheel centers.....	American Steel Casting Co.
Tires.....	Midvale
Axles.....	S. L. W.
Sight-feed lubricators.....	Nathan latest improved
Bell ringer.....	Gollmar
Couplers.....	Chicago
Safety valve.....	Ashton
Sanding devices.....	Dean's
Injector.....	N. & Co. Monitor No. 9, Type "R" of 1897
Driver brake equipment.....	American
Tender brake equipment.....	Westinghouse
Tender brakebeam.....	Kewanee
Tender brakeshoe.....	Ross-Meehan
Air pump.....	Westinghouse, 3/4 in.
Air pump governor.....	Westinghouse
Steam gauges.....	Ashcroft

## The Limits of Steam Pressure in Locomotives.

BY G. R. HENDERSON.

The great increase in locomotive boiler pressures in the last 10 or 15 years has naturally led to the thought whether this increase would still continue, and where the limits will be found.

Fifteen years ago 125 pounds per square inch was considered a standard pressure, although a few roads were working up to 140 pounds and 150 pounds. Nowadays 200 pounds pressure is very commonly employed. While this has been brought about largely by trying to benefit especially the compound locomotive, yet it has also resulted in increasing the pressure for simple locomotives.

At present Continental Europe seems to be ahead in boiler pressure, in simple as well as compound engines. In this country and in Great Britain the maximum limit is 200 pounds, but the Saint Gotthard Railway is using 205 pounds on a compound locomotive, the Paris, Lyons & Mediterranean Railway 213 pounds on a simple engine, and at the Brussels Exposition this year the Belgian State Railway exhibited a compound locomotive operating with a gauge pressure of 220 pounds per square inch. We believe that these are the highest pressures used, up to this date, on locomotives. Some marine pressures have exceeded this, but the majority are thought not to run over 200 pounds.

The question therefore arises, what is the advantage of this greater pressure, and what are the difficulties to be overcome in operating it?

Some years ago a prominent railway of Great Britain made some tests to determine what pressure was the most economical in a certain passenger service, and it was commonly reported that the results showed that 160 pounds gave the greatest economy. Desiring to confirm this fact, we wrote to the locomotive superintendent (with whom we have the pleasure of an acquaintance) and his reply was entirely different from what was currently believed.

The engines used in making the comparative tests were of the following proportions:

Diameter of cylinders.....	18 inches
Stroke.....	26 "
Driving wheels (4) diameter.....	78 "

Heating surface, tubes.....	1,090	square feet
" " firebox.....	112	"
" " total.....	1,202	"
Grate area.....	19.5	"
Weight of engine.....	45 long tons	
tender.....	40	

The results of the test are shown by the following table:

SUMMARY OF RESULTS OF HIGH STEAM PRESSURE TEST.

No. of Eng.	Steam pressure.	1st Section.				2d Section.				E
		A		B		A		B		
		C	D	C	D	C	D	C	D	
76	200	153	49.14	153	53.90	268	51.04	228	51.4	.....
77	175	138	50.63	138	56.94	259	52.25	217	46.20	10.94%
78	150	137	49.14	151	53.90	237	52.57	246	43.67	22.15%

A—Up journey. B—Down journey.  
C—Weight of train in tons. D—Speed in miles per hour.  
E—Excess of steam used per horse-power per hour as compared with 200 pounds pressure.

The trials were made in October and November, 1889.

These results, as far as they go, do not need any comment. The well-known formula for the efficiency of a heat engine  $\frac{T_1 - T_2}{T_1}$

(in which  $T_1$  is the absolute temperature of entering steam, and  $T_2$  the absolute temperature of exhaust steam), indicates the advantage of high temperature steam. R. Clausius, in his "Mechanical Theory of Heat," says that "in order to get the greatest advantage from engines driven by heat, the most important point is to increase the temperature interval  $T_1 - T_2$ ."

William Kent, in his "Mechanical Engineers' Pocket Book," page 747, shows the effect of working steam expansively, and as there is a minimum limit for the exhaust pressure, on account of retaining the proper action on the fire, this can be construed to explain the advantages of high pressure.

These are in a measure, however, offset by cylinder condensation, which has generally been considered as being dependent upon the ratio of expansion, and various tests of simple engines have indicated that a cut-off of from .2 to .3 of the stroke was the most economical.

Later experiments point to the belief that the actual expansion ratio has practically no influence on the amount of condensation per stroke (Kent, p. 753) but that the condensation depends upon the difference in temperature of the admission and the exhaust. This leads us at once to the advantage of the compound engine, in which this difference is much less in any one cylinder, and this applies, no matter whether the condensation depends upon the ratio of expansion or the variation in temperature solely.

If, in a simple locomotive, we assume that we should not have a higher terminal pressure than 25 pounds per square inch, a cut-off of .2 would call for an initial pressure of 185 pounds (by Mariotte's law) or say 200 pounds in the boiler. A higher terminal pressure or an increased expansion would not be economical, as seen above, the first on account of the high value of  $T$ , and the second on account of increased condensation. This would indicate that 200 pounds is about the economical limit of cylinder pressure for simple locomotives.

Compound locomotives enable us to reduce cylinder condensation by having less difference in temperature between the admission and exhaust. The ratio of the cylinders of compound locomotives varies from 2 to 3; 2.5 may perhaps be considered an average value. Seaton, in his "Manual of Marine Engineering," recommends an increased cylinder ratio with greater pressures, but this does not seem to be adhered to in locomotives. The most economical point of cut-off does not appear to be definitely fixed for compound locomotives, but it is probably between  $\frac{1}{4}$  and  $\frac{1}{2}$  stroke of the high-pressure cylinder. This would give a total expansion of 6, and if we desire a maximum terminal pressure of 25 pounds, as above, the limit of initial pressure would be 225 pounds, or say 240 pounds boiler pressure. Of course, these are not advanced as being the final limits which boiler pressures will reach in locomotives, but they are suggestions of what will probably be found to be desirable limits for cylinder pressures.

In an editorial of the November issue of the AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL there was a sugges-

tion as to the use of higher boiler pressures, with cylinder pressures about as indicated above. This proposition we consider perfectly possible and logical from an engineering standpoint.

There is no difficulty in making a boiler that will be safe for this or even higher pressures, but as we increase the strain the maintenance becomes more troublesome. Staybolts and flues promise to become restive, owing partly to the increase in expansion due to the higher temperature; and partly to the greater pressure directly. It is probably quite true that the greater amount of trouble experienced with flues now, to what it was a few years ago, is due largely to the high pressures carried.

Relief from these troubles may be found in other forms of fireboxes and boilers, and the water tube boiler, the Docteur brick-lined firebox, or the corrugated cylindrical firebox (like the Strong boiler) each and all promise to overcome some of the troubles mentioned. There is no doubt that some radical departure from the old lines of locomotive construction would be gladly received by progressive railroad officials.

There are other incidental difficulties, however, in the matter of cylinder and valve lubrication. A good cylinder oil should not flash below 525 degrees Fahr., or burn below 600 degrees, the lubricant being mineral oil with from 15 to 25 per cent. of animal oil mixed with it. The temperature of steam at 240 pounds pressure is about 400 degrees Fahr., and it is probable that a still heavier oil could be used with advantage.

The white metal in the metallic packing on piston rods and valve stems must also be considered. If it is proportioned so as to resist a high temperature without melting, the rings become so brittle that they will break in pieces in service; if made tougher the melting point is too low.

A few years ago, we undertook some tests, to determine what mixture was most desirable for metallic packing rings. The compositions experimented with were as follows:—

Mixture	1.	2.	3.	4.
Tin.....	87	90	93	93
Copper.....	8	7	6	3
Antimony.....	5	3	1	2
Lead.....	—	—	—	2

No. 1 was the mixture recommended by the United States Metallic Packing Company.

No. 2 was our own formula.

No. 3 was recommended by the Columbian Packing Company.

No. 4 was the result of an endeavor to get a tough, easily molded metal. It was found that while No. 1 had the highest melting point, viz., 448 degrees Fahr., yet it was so brittle that it stood no bending, but snapped off short.

No. 2 melted at 441 degrees, but was not so brittle.

No. 3 had a melting point of 432 degrees but this was quite flexible, a strip  $\frac{1}{4}$ -inch thick bending to a right angle before cracking.

No. 4 was tough, and ran easily in the mold, but the melting point was only 420 degrees Fahr.

Taking these different properties into consideration, we found that it was quite difficult to decide on the mixture which would be generally best to use. We might add at this point that it is quite important to use new metals only when making up the mixture for metallic packing rings.

In the above, we have merely attempted to outline what would be the probable limit of steam pressures in locomotives, and also some of the difficulties that may be encountered in reaching and using such pressures. These troubles will probably be overcome after further experimenting, and in the future pressures now considered uncommon may be controlled as easily as those now in use. Steam jackets may bring about a greater expansion ratio, with its increased economy, but any arrangement which adds to the complication of the locomotive is apt to be considered with much conservatism—in this country at least, and rightly so. With the longer runs and shorter times at terminals, simplicity of construction has economic features, as great, possibly, as a fair saving in fuel, and this factor cannot be ignored. Even the Corliss valve, so highly thought of, for stationary engines, while it has met with some favor in France, has been totally neglected in this country as far as locomotives are concerned. The same applies also to separate cut-off valves and in general simplicity of mechanism, and the reduction of parts to look after and keep in repair are thought to be among the most important principles in railroad engineering.

## Labor and Our Railroads.

The report of the Interstate Commerce Commission just issued contains for the first time some facts in relation to the total amount of money paid out by our railroads in wages and salaries to labor. These figures, embracing 99 per cent. of all employees, show that for every \$100 paid out as operating expenses of railways more than \$60 is paid over directly to labor. Of the remaining \$40 probably an equal, if not a greater, proportion is indirectly paid out for labor.

The interest of labor in the railway question is far greater than the interest of capital, and yet, for some unknown reason, says Robert P. Porter in the *New York Sun*, the defense of these properties has been left to capital, while labor has, until a comparatively recent time, taken little interest in the conflict. During a period of nearly 25 years there has been more or less national legislation and an infinite variety of State legislation in relation to railways, and yet during that whole period experts inform us that legislation has never been friendly, but always unfriendly, to railway interests. As a consequence of this, the capital originally invested in railways has lost its earning power, and for every \$100 thus invested more than \$70 has no earning power.

During this period there has been no reduction in the rates paid labor, but in one way labor has suffered and severely. The plight in which our railways have found themselves has not only actually reduced the number of wage earners employed, but, relatively to the increase of mileage, has prevented the employment of additional hands. On the basis of 200,000 miles of railways, we should employ at least five hands for each mile, giving direct employment to 1,000,000 persons. Instead of this, we had only 826,620 persons employed in 1896. Thus, while Populistic legislators are joyously dilating over the manner in which they have destroyed the earning powers of the railway monopolists, the heads of nearly 200,000 American families, representing nearly 1,000,000 men, women and children, have been seeking in vain for a job. On the other hand, had half the annual earnings, say at 5 per cent., of upward of \$4,500,000,000 of stock and bonds now in default been applied to the pay of labor employed in the maintenance of these properties, as over 60 per cent. of them would have been, every one of these homes might have been prosperous and happy.

The facts show that two-thirds of the capital invested in railways is to-day earning nothing, without counting the 16 per cent. of bonds in default of interest. On an estimate of 200,000 idle men out of 1,000,000 our railways should employ, if prosperous, 20 per cent. of the labor is earning nothing. If the rates continue to decline and properties to deteriorate, labor, which, even under these adverse conditions, is receiving far more than capital, will come next, and reduction of wages, with all its attending horrors, must come, not as a matter of choice, but of necessity, because a greater share of the capital has already gone down under adverse legislation and the terrific competition which has continuously and unreasonably reduced the earning powers of so many of these great enterprises. In 1896 the official figures show that of the operating expenses alone the enormous sum of \$468,824,531 was paid out in wages and salaries. This does not represent the sums indirectly paid for labor, but only those directly paid. Relatively to labor, dividends, interest, rentals and so forth, are comparatively small. The time has therefore come for the labor interests of the country, directly and indirectly dependent upon railways, and the immediate business interests all over this vast domain of ours, whose prosperity is equally dependent upon the success of these undertakings, to look over the situation and decide for themselves if it is not time to cry a halt on all legislation which has for its direct aim the further wrecking of interests so tremendously interwoven with the welfare of every class of labor.

The Union Pacific Railroad was sold to the reorganization committee Nov. 1, 1897. It was sold under a mortgage, which was held by the United States government, and the bid of the committee was \$39,883,291 for the property itself and \$18,615,250 for the bonds held in the sinking fund. In addition to these bonds, the sinking fund holds \$4,036,400 in cash, which reverts to the government, and which makes the total amount paid the government \$57,564,932. The purchasers have 90 days in which to pay the full amount of the purchase money in accordance with the terms of the sale.



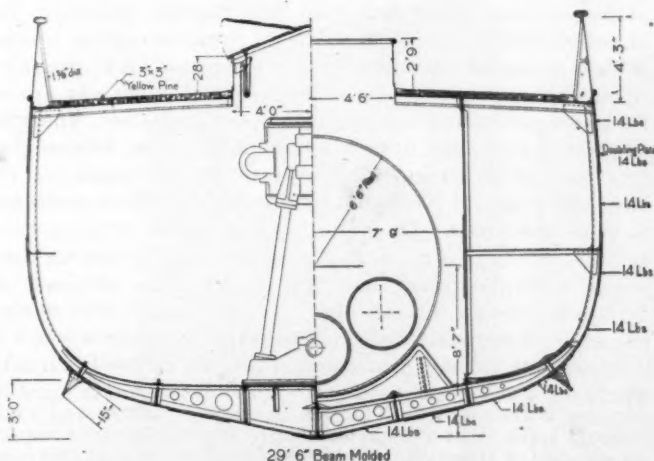
A distilling apparatus with a capacity of 3,500 gallons will be placed in the engine room. The main steam pipe will be of copper and 7 inches in diameter.

There will be nine transverse water tight bulk-heads stiffened by 3 by 2-inch vertical angles spaced two feet apart. The transverse frames which are spaced two feet apart are of Z section 5 by 3½ by 3½ inches and weighing 11.6 pounds per foot. The upper flange of the Z will be cut off from the turn of the bilge to the lower end of the frame forming an angle bar 4 by 3 inches. The main frame bars are to be cut off against the lower angles of the vertical keel plate and the reverse bars are to butt against the vertical keel plate.

The vertical keel shown in the midship section will be 21½ inches deep and of 15 pound plate. The flat keel plates are double and are worked in 18-foot lengths. The flat keelson plates will be 9 inches wide on each side of the vertical keel, and tapered at the ends of the vessel. The bilge keels

extend a distance of about 110 feet amidships, and stand normal to the bilge; they are to be formed of 10-pound plates, riveted at the outer edges to a 2½ by ½ inch flat bar, while the inner edges are held to the plating by angles and tap rivets. The bilge keel plates will be filled in with yellow pine, as shown in the midship section.

The main deck beams are to be of angle bulb section, 6 by 3 inches, a beam being provided at every frame and the spring being 6 inches in a length of 29½ feet. The berth deck beams



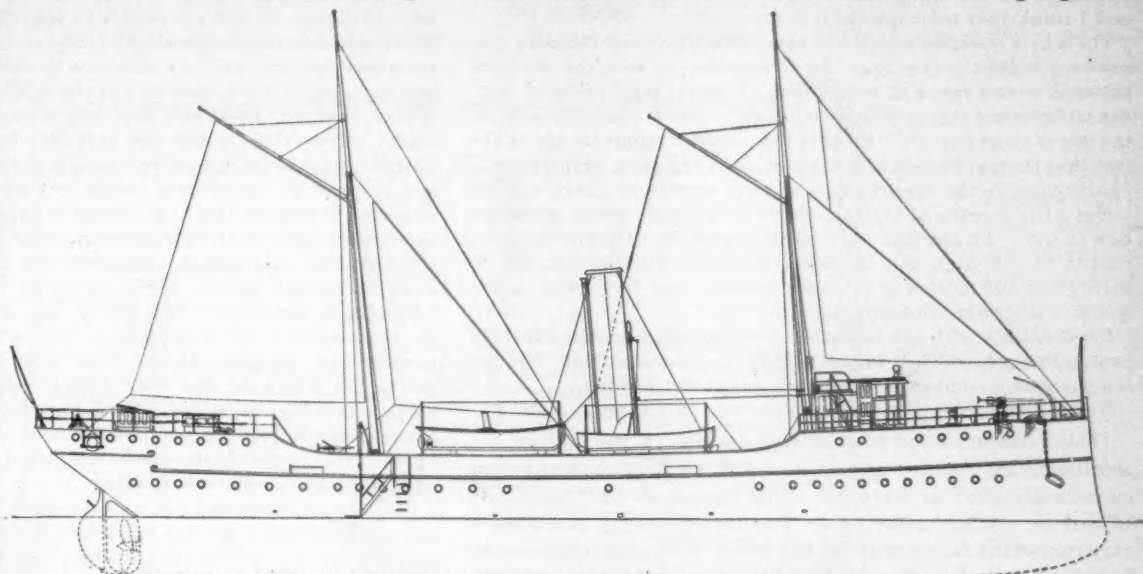
Midship Section.

will be of 3 by 2½-inch angles and straight. The fore-castle and poop deck beams will be of 3½ by 2½-inch angles. The stanchions are to be tubular and of wrought iron.

There are to be three longitudinals on each side of the vessel, and continuous angles will be placed on the inner edges, while the lower edges will be flanged to the outside plating and all will be formed of intercostal plates. The outer plating is shown in the larger sectional view, the bulwarks and sides of fore-castle and poop are to be of 10-pound plate. For a length of about 100 feet amidships, an additional sheer strake or doubling plate will

be used and a similar method of strengthening will be used on the bow to a point 28 feet each side of the stem and 4 feet above and 4 feet below the water line. The stem will be of one piece of 7 by 2½ inch iron rabbeted to receive the plating. The stern frame is to be of wrought iron in three pieces.

The pilothouse and chartroom are the only projections above the fore-castle deck. The roof of the chartroom will be extended to the sides to form a bridge. The quarters of the petty officers and men are under the fore-castle deck. The steering engines are



United States Revenue Cutter No. 6.—Outboard Elevation.

under the pilothouse and it is not yet decided whether steam or pneumatic gear will be used. The tiller ropes will be ½-inch steel wire cables and will lead under the main deck beams, passing through brass pipes through the wardroom. The wardroom is at the after end of the berth deck, the bulkheads being of white pine. Each stateroom contains a berth, with drawers and lockers below, a small bookcase, portable desk, and a locker, all furnished in quartered oak. Parquetry flooring of oak will be used. The wardroom dining-room will be 11 feet long and the entire width of the vessel. The wardroom pantry adjoins the dining-room and on the opposite side of the vessel is the executive officer's office. The cabin stateroom, lavatory, office, pantry, passage and aft cabin are to be constructed of white pine panel work with festoons of composition for decorations, to be finished in white and gold. The floor is to be of oak parquetry with a neat border.

The cabin will be finished in white and gold with white pine panel work and composition festoons. A small cabin will be fitted up at the extreme after end of the main deck and will have a seat running around the stem of the vessel upholstered in pebbled leather. The captain's office is at the forward end of the house on the starboard side and is to be fitted in a convenient manner.

The vessel will have two trimming tanks formed by the hull proper at the extreme forward and after ends. These will be filled and emptied by valves worked from the deck above. The steam heating and sanitary fitting and piping system will be very complete and the vessel ought to be a comfortable one. From a careful examination of the whole design including the machinery it appears to be admirably adapted to the purpose for which the vessel is intended.

#### American Electric Railroad Apparatus in England.

Electric tramway installations of a high grade of excellence can be bought, but, if we accept the testimony of experts, they cannot be bought in England, says the *Railway World*. Certainly they cannot be obtained here with the economy and the confidence that they can be bought in America. And so when important contracts for electrical tramway apparatus are to be made we have a beggars to New York, and a foregathering in palatial hotels of the representatives of American firms from the Atlantic to Chicago. A swift and sharp competition follows, and our tramway managers and contractors return thoroughly satisfied that they have saved their companies' money and at the same time have secured the best electrical apparatus that can be obtained. How large a share the Americans will play in developing the field here depends largely on their own enterprise. At present the advantage is with them. Their apparatus is unsurpassed. American manufacturers were shrewd enough to understand that it was the era of local transport and they stopped short of no possible efforts to put themselves in a position to meet and even to encourage every demand.

## Communications.

### Throttling vs. Expansion.

EDITOR AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL:

I have read the discussion of the subject of throttling vs. short cut-offs in the November issue of your paper with much interest, and I think your treatment of it is excellent.

The whole question which you raise is really a very complex one, growing out of the fact that the locomotive is required to work under so wide a range of conditions. I think that cylinder condensation is not the only important factor which operates against the use of short cut-offs. Equally important it seems to me is the fact that the mechanism of a locomotive of ordinary proportions is hardly equal to the requirements of good service at short cut offs under a full throttle at high speeds with the high steam pressures now in use. An attempt to run an engine in this way so often results in hot pins and in defective steam distribution, due to spring and lost motion in valve mechanism, that the result on the whole is somewhat discouraging.

I say this not with the intention of detracting from the efforts of your argument, which, I take it, needs no reinforcement, but for the purpose of emphasizing another side of the question.

Nov. 3, 1897.

MEMBER A. S. M. E.

[This communication was written by one of the highest authorities in the country upon the steam locomotive, and we are exceedingly glad to have his indorsement of the suggestion offered in our November issue. Our correspondent mentions a very important failing that is beginning to be appreciated when he refers to the defective steam distribution that is caused by the springing of valve gears. In our October number (page 356) an account of some tests containing large and small locomotive valves was given wherein this flexibility of valve gear was believed to explain some of the apparent advantages of small over large valves, and there is plenty of evidence to be had to convince anyone that a perfectly balanced valve is greatly to be desired. This suggests the great advantage possessed by piston valves with respect to the low frictional resistance, and we believe that the trouble which our correspondent mentions may be almost entirely overcome by using them.—EDITOR.]

### Crank Axles.

EDITOR AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL:

Referring to the communication on page 376 of your November issue, by Mr. Merrill Davis, we would say that we think there are many objectionable points in crank axles. They are quite expensive to manufacture and finish up, and certainly are much weaker than straight axles.

When at the Crewe shops of the London & North Western Railway, the writer was informed that all crank-axles, and particularly on passenger engines, were removed and scrapped after making a certain mileage, the amount of which has now been forgotten.

The arrangement of the valves and cylinders with such inside connected locomotives is generally very difficult to repair and inspect, and we think that all practical railroad men will agree that outside connected engines are preferable, in nearly every case, to those requiring inside crank axles.

NORFOLK & WESTERN RAILWAY,

Roanoke, Va., November 8, 1897.

G. R. HENDERSON.

### Steam Motor Cars.

EDITOR AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL:

The illustrated description of the steam motor car for the New England Railroad which you published last month interested me, and in view of the prominence given to the same subject in the editorial pages of that issue I am prompted to present some suggestions in the way of serious difficulties which I believe will be found in connection with the proposed system.

I think you are correct in believing the managers of the steam railroads to be at their wits' ends to know how to meet the electric

railroad competition, but I think that the idea of using combination steam locomotives and cars for this purpose is not good railroad-ing. It is very easy for an editor who sits at a desk to theorize over such questions, and he is very likely to overlook some practical objections involved in such a radical idea as this. I believe in your enthusiasm over a new idea you have not considered some very important sides of the plan the New England Railroad proposes and you endorse.

In the first place it will be impossible to operate such an outfit with two men. It will not be safe to load the care of an engine and boiler as well as the operation of the car upon one man, and I am surprised that you lend any influence to such an idea. Instead of less we ought to have more men at the head ends of our trains. It is plain that with these cars shuttling in and out among the regular traffic trains of the roads the necessity for watching signals and guarding against things going wrong generally will be increased, and one man will be entirely unable to meet the requirements. By your own statement this new scheme is expected to increase travel and that will not improve matters any, but will make them worse.

I can see another very serious obstacle in the fact that these cars must be turned around at the terminals and it requires a large turntable to turn a car with a wheel base as long as 57 feet. You do not consider the expense of putting in these tables or of maintaining and operating them. They may be operated by steam power, but if by hand, the train crews could not do the work and extra help would be needed. Even then the wages cost might be lower than at present, but not so much lower as you appear to expect, and the cost of the turntables would be extra expense, when saving money is what we are after.

I look more favorably upon a plan that would make use of the old engines which are too light for heavy business and for an example point to the Illinois Central method of handling the World's Fair passenger business out of Chicago for which I believe not a single new engine was bought.

When the old light engines are used up it will be time to build new ones. These ought by all means to be independent of the cars for the reason stated and because it will be impossible to prevent the heat, noise and smell of the locomotive from annoying passengers at the other end of the car.

I do not oppose the idea of light steam power, but I believe the plan outlined to be wrong, and I am surprised to find it advocated by a first-class railroad.

Nov. 3 1897.

T. A. WESTERVELT.

[We thank our correspondent for this opportunity to emphasize some points which we have already touched upon in the description of the new steam motor car for the New England Railroad. The argument with regard to the use of old worn-out engines in what is likely to become one of the most important fields of passenger transportation is not sensible. The most convenient way to turn the motor cars around will be by the use of turntables. These are however, not essential to the success of the plan, because they may easily be turned on "Y" tracks, or in the manner that the large motor cars of the Twin City line, between Minneapolis and St. Paul, are turned. Those cars have but one set of controllers, and they are turned at each end of the runs by passing them around a city square. If, however, a turntable is necessary, no extra help is required to operate it if it is equipped with an electric motor in accordance with a plan that is outlined elsewhere in this issue. It has been demonstrated that on elevated railroads, where the interlocking signals are by no means few in number, one man is abundantly able to run the train in safety; and while it would appear that a steam locomotive would necessarily require a great deal of attention, we have reason to believe that this combination may be safely handled in this way. These motor cars will be run on the railroad right of way and not through the streets; the boiler will not require any attention between stations and the locomotive is as easy to operate as an electric motor. If necessary, it will be a comparatively easy matter to fit the boiler with an automatic stoker, which will dispose of the work of feeding the fire for an entire trip, and the water-level in this type of boiler may fluctuate enough without danger to effectually dispose of the question of the necessity of watchfulness in feeding the boiler. To separate the locomotive from the car will defeat the chief object of the plan. The combination idea is one of its most valuable features, because in no other way can the subdivision of train units be carried out as in electric railroad practice, and the most valuable lesson that steam railroad men have to learn from electric practice is the necessity of using small and frequent units in suburban service.—EDITOR.]

### The Edge Moor Water Tube Boiler.

The experience of the Edge Moor Iron Company, of Edge Moor, Del., in the construction of steam boilers has been brought to bear in the production of a new boiler of the water tube type, which we are glad to describe and illustrate in the accompanying engravings, from which the new features will be readily understood.

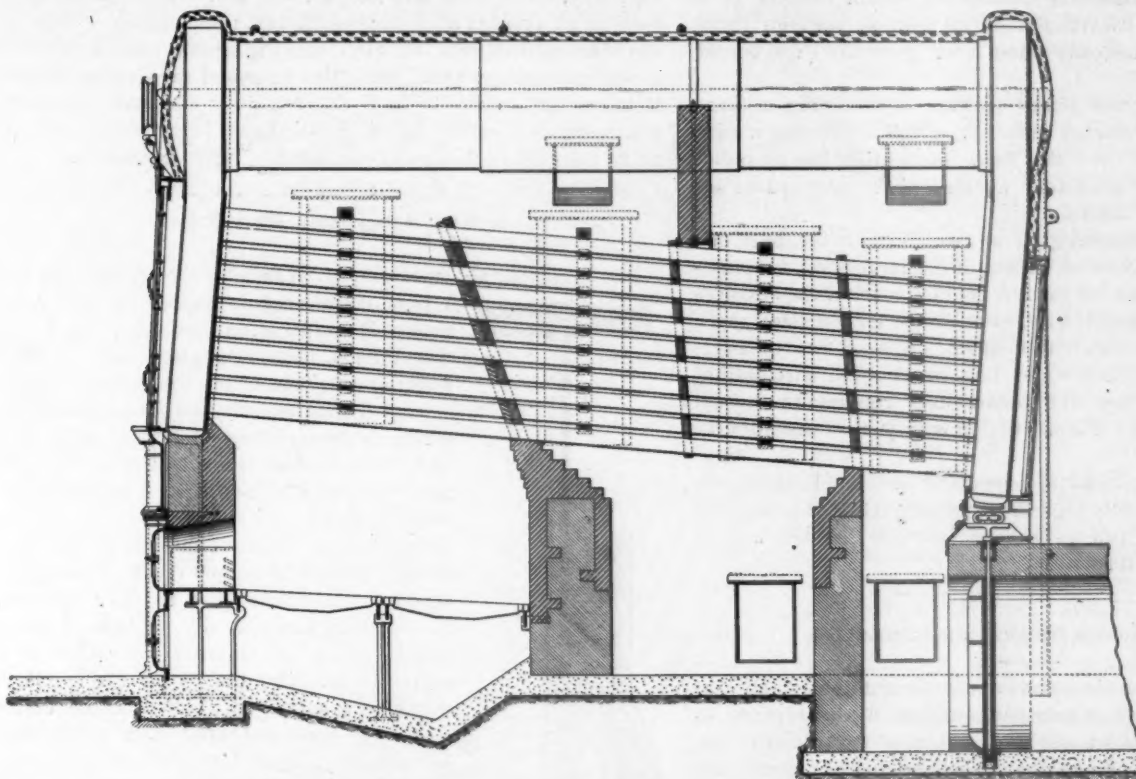
The boiler is constructed in four sections, consisting of drums,

upper and lower headers and the tubes. The drums and headers are constructed entirely of flanged steel. The drums enter the headers at their full area, to which they are connected by flanges, avoiding the necessity of cutting the drums to make a connection for the headers, and creating a solid steam and water connection between all drums without the use of outside connections. The upper header is domed opposite each drum, thus avoiding large, flat surfaces.

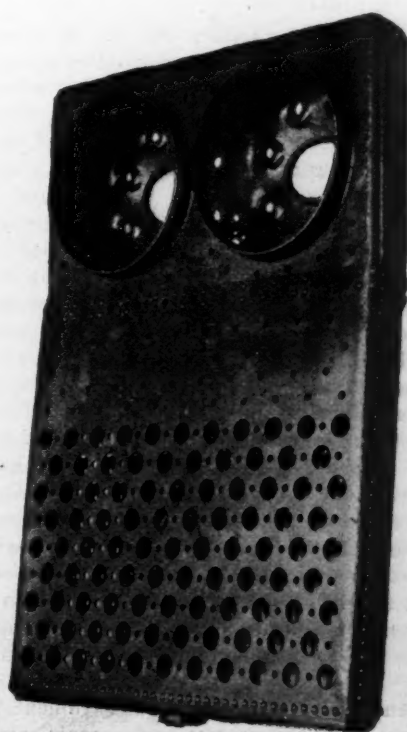
The tubes are expanded into the inner side of the lower header,

and opposite each tube a flanged oval hole is provided, faced and fitted like an ordinary manhole with oval cover and dog. The covers, being on the inside of the header, are tightened in position by the boiler pressure, and each cover is independently removable.

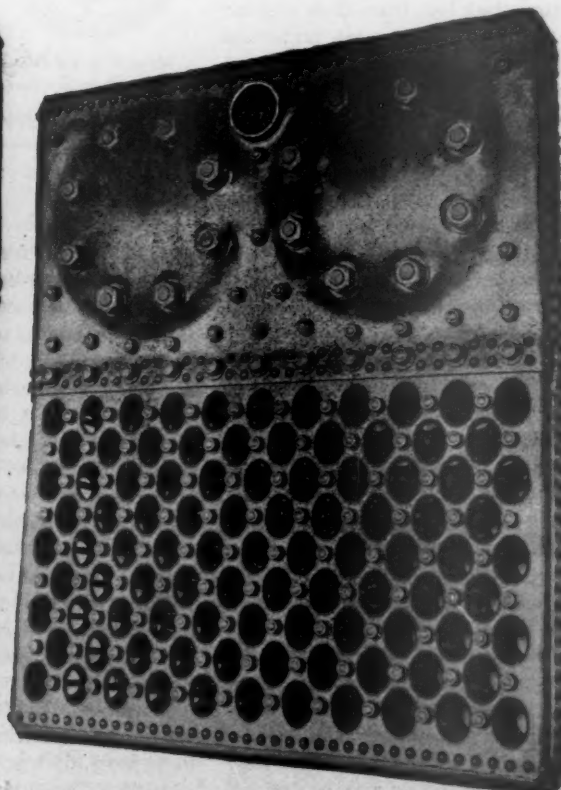
The flanging of the front plate of the lower header stiffens this plate and the joint surfaces rendering the joints easier to keep water tight and necessitating fewer stays, as this feature eliminates largely the extent of flat surface. The upper and lower headers are connected at an angle



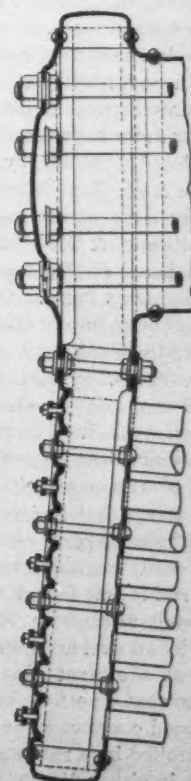
The Edge Moor Water Tube Boiler.



Inside View of Two Drum Back Header Showing Flanges for Shell Connection.



Front View of Two Drum Front Header.



Cross Section of Front Header

to give sufficient inclination to the tubes to insure a positive and rapid circulation.

Special attention is directed to the arrangement of the baffle plates, which is such that the gases are forced to surround every part of the tube heating surface and the lower side of the drums, and enabling the gases to reach the stack through an underground flue, obviating the necessity of a heated sheet-iron connection in the boiler-room. By means of the construction of the headers, and their connections to the drums, unusually large water areas are obtained for circulation, which reduces to a minimum the usual contraction of circulation through these parts, and avoids the unsteady water level generally experienced under forced firing.

The arrangement of the drums permits of obtaining a large liberating surface and storage capacity, as well as forming a solid water heating surface over the tubes, preventing loss by radiation, which cannot be altogether avoided where large spaces are necessary between the drums.

In general, while possessing to a great extent the best elements of water-tube types of boilers, it has large areas for circulation; the gases are carried in close contact with all the effective heating surface, and practically, even in the largest sizes, there is one drum with the water and steam space of two or more, thereby insuring a steady water line, unimpeded circulation, effective heating surface, dry steam, quick response to unusual demands, and simplicity of construction with perfect accessibility to all parts.

There are so many special features about each application of a boiler in practice that only a general consideration can be given in a brief description, and we believe that the builders will be glad to give further information.

#### Electric Motors for Driving Turntables.

The turning of locomotives and cars at division points and terminals is a source of much annoyance and no little expense to railroad companies. Workmen are not usually especially employed for this service, but engine wipers and helpers about the engine-house are called upon each time the turntable is used. The number of men that usually assist in this work is four, two at each end of the table, and the time they lose from their regular duty is considerable, as they are frequently in the pit under an engine, in the engine-house or on top of an engine or in some other inconvenient place when called and their movements are often slow because there is no incentive to hurry.

In our June issue, page 191, of the current volume a system for operating turntables by electric motors on the Chicago, Milwaukee & St. Paul Railway was illustrated and we are now informed that a somewhat similar plan has been worked out on the Baltimore & Ohio Southwestern Railway. The general master mechanic of that road estimates that it costs 12 cents to turn each engine by hand. Observing the delays and the expense attending them, one of the master mechanics about two and a half years ago worked out a plan for turning the 60-foot turntable at Chillicothe, O., by means of an electric motor. This motor was applied to an old car wheel by cast-iron spur gear wheels, so as to reduce the speed. The car wheel and motor were attached to a frame which was hinged to the gutter of the turntable, the car wheel to run on the circular rail or the track of the turntable. It was found that the weight of the frame, motor and car wheel was sufficient to give necessary adhesion so that the tractive force would easily turn any engine.

On trial it was found that the heaviest engine could be turned completely around in 56 seconds. The current is carried to the motor by an overhead wire which is connected directly over the center of the turntable by two brass rings insulated with hard wood so that a perfect contact is always obtained, thus furnishing a good conductor for the current to the motor. The current is controlled by a rheostat and switches, so that the motor may be run in either direction and at such speed as may be desired. This is done by a simple lever which is moved back and forth.

The cost complete, including the motor, did not exceed \$500,

and after two and a half years' use the device seems to be in excellent condition, and has given such good satisfaction that it was decided to operate the turntable at Park street, Cincinnati, O., in a similar manner, except that the current is taken underground, and connection was made around the center cone of the table so that all wiring is concealed, thus presenting a neater appearance.

The electrical power is purchased from the Union Depot Company through a meter. The cost of this power for four months, viz., May, June, July and August, was \$29. This turntable is used on an average of 50 times each day, thus making a cost of less than one-half cent for each time the table is turned, while if it was operated by hand, using the figures of the General Master Mechanic (12 cents for each engine), it would have cost \$738, which shows a saving of \$709, no allowance being made for repairs; the repairs, however, will never be very expensive.

#### A New Armstrong Pipe Cutter.

The engraving shows an improved form of the well-known No. 3 pipe cutter, manufactured by the Armstrong Manufacturing Company. This tool, it is claimed, is the strongest and most rapid working pipe cutter on the market, and it is also the cheapest; this by reason of its taking a larger range of pipe than any tool known that is made for a like purpose, viz., from 1½ inches to 4 inches, inclusive.

The change from the smallest to the largest size is made by simply raising a pawl and allowing the hooked bar to slide outward. To change to a smaller size the hooked bar is pushed in to the required size, when it is ready to cut. The thread on the handle is only used to follow up the cut as the cutter is revolved about the pipe. This cutter may be changed from a three-wheel to a one-wheel cutter by simply substituting rollers in place of the two cutter wheels at the end of hooked bar.

New No. 3 Armstrong Pipe Cutter.

Full information will be furnished our readers upon application either to the home office of the Armstrong Manufacturing Company, at Bridgeport, Conn., or 139 Centre street, New York City.

#### Sexton's Omnimeter.

A convenient form of calculating instrument, similar in principle to the well-known slide rule, has been devised by Mr. Sexton, who is connected with the Southwark Foundry and Machine Company, and placed upon the market by Messrs. T. Alteneder & Sons, of Philadelphia. The new instrument is in the form of circular non-absorbent disks of bristol-board, secured concentrically upon a pivot fastening so that one may be revolved with relation to the other, and may be secured in any desired position by a thumb screw. The disks, as shown in the accompanying engraving, carry concentric circles accurately divided into parts which are proportional to the logarithmic values of the functions which they represent, and the principle upon which the instrument is arranged is that of the slide rule, namely, that the logarithm of the product of two numbers is equal to the sum of the logarithm of the numbers and the logarithm of the quotient of two numbers is equal to the difference of the logarithms of the numbers.

A number of functions are given on the instrument, among which are logarithms, numbers, squares, square roots, cubes and cube roots, fifth powers and root, sines, tangents, versed sines and secants. There are several forms of the omnimeter, and the most complete have all of these functions, while the less complete, sold at a lower price, have less of them.

The omnimetre which is before us is one of the most complete, the price of which is \$3, while the other forms cost \$2 and \$1. The one with which we have experimented is a fine piece of work. The disks are very well made and printed and the instrument is provided with a transparent arm bearing a fine radial line for the purpose of assisting in the calculations. The one illustrated is set in such a way as to permit of the multiplication of a number by 3. It will be noticed that the numeral 1 on the "B" circle (see the oblique, nearly vertical line at the lower side of the engraving) is opposite the numeral 3 of the outer or "A" circle.



Sexton's Omnimetre.

circle. To multiply 4 by 3 find 4 on the "B" circle and opposite it on the "A" circle is the answer 12. This is a very simple illustration, but it will serve to show the ease with which the instrument may be used. Though the processes make use of logarithms, no knowledge of logarithms is required in the use of the instrument. The omnimetre is copyrighted by Mr. Thaddeus Norris, of Philadelphia, who has devoted a great deal of careful attention to the arrangement and construction of the instrument, and as far as a few simple calculations can be convincing of its value the omnimetre appears to be very satisfactory. It is worthy of investigation.

#### The Railroad Problem.

At the three fall conventions of the New York Board of Trade and Transportation held during the month of October a number of valuable and interesting papers were read, among which was one upon The Extension of the Powers of the Interstate Commerce Commission by the Hon. Martin A. Knapp, Chairman of the Interstate Commerce Commission, which gives a clear and thoughtful review of the railway question and of the legislation, which is necessary alike for the permanent advantage of the public and the railways. In opening his address he makes clear the important distinction between injustice by rate-cutting and injustice in rate-making. The Commission, Mr. Knapp claims, is powerless to ferret out the various devices by which preferential rates are obtained and to punish railroad officials for failure to observe their published schedules. These, he contends, are discriminations between individuals, and should be placed in the category of misdemeanors. No amendment in the law by Congress in the direction of giving the Commission greater power in enforcing penal

remedies for rate-cutting, he thinks, will meet the case, but the remedy may better be found in legislation which will remove the cause for this species of wrongdoing. In Mr. Knapp's opinion, it can best be stopped in this way:

How can rate cutting be stopped? The most efficient and available remedy for this evil, in my judgment, is legalized pooling. The carriers should be permitted and encouraged to contract with each other for the movement of competitive traffic, and thereby have it in their power to restrain and control the unseemly strife which inevitably results in fluctuating rates and vicious discriminations. The benefits supposed to result from railroad competition I believe to be greatly exaggerated. Those who uphold the present policy apparently assume that the public gets the same sort of advantage from competition between carriers as from competition between producers and dealers generally. That this is a mistaken and fallacious view I am fully persuaded. I do not see how anyone can derive benefit from competition in the matter of his daily wants, unless he is in a situation to choose freely between two or more persons who are each able to supply those wants. The objective value of competition rests in the power of selection, and he who is debarred from choice must be deprived of any direct advantage from the rivalry of others. As to most of our wants—broadly speaking—every person in every place has the opportunity to choose. And this liberty of selection is commonly enjoyed as to the ordinary needs of life, whether simple or complex. But in respect of railroad transportation only a few people comparatively are so situated as to have any available choice between carriers. So that, without amplifying the argument, the simple fact is that only a small percentage of population, and an exceedingly small fraction of territory, are so located as to have any practical opportunity for selection in the matter of public carriage. To the great majority of people railway transportation is now a virtual monopoly. The result is that a few commercial centers and a few large shippers, having this power of choice, and finding their traffic indispensable to the carriers, secure great advantages of which the masses

are deprived. It is entirely plain to me, therefore, that co-operative methods, the general discontinuance of competition in rates between rival railroads, would tend strongly to remove the inequalities which now exist, and prove a positive and substantial advantage to the great majority of producers and consumers.

In advocating this plan of action, Mr. Knapp is advancing along the lines of the experience of railway management, not only in the United States, but in England and in all other countries where railways are not under State control. Such a course of action would undoubtedly secure that uniformity and stability of rates which all right-minded men desire. Mr. Knapp takes the ground that carriers should be allowed to combine their facilities to the end that wasteful warfare between them may be prevented and the economies of association applied to the business of public transportation. The Interstate Commerce Commission distinctly sets forth that such combination would in no way increase rates to the public, because it would be within the province of Congress to clothe the Commission with proper authority to enforce just and reasonable rates. Fair and workable laws, he says, should be enacted to protect the public interests against exorbitant rates and when there are secured, the public have no particular interest in the manner in which the business is divided between the several competing roads. The first question is of vital interest to the public, the second of little importance.

Our contemporary the *Railroad Car Journal* is likely to work itself into a state of nervous prostration, or something else, over an alleged abduction of the Master Car Builders' Association by the Master Mechanics' Association. Who are the men in charge of the car departments, anyway?

(Established 1832.)

# AMERICAN ENGINEER

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28TH YEAR.

66TH YEAR.

PUBLISHED MONTHLY

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### EDITORIAL ANNOUNCEMENTS.

**Advertisements.**—Nothing will be inserted in this journal for pay, EXCEPT IN THE ADVERTISING PAGES. The reading pages will contain only such matter as we consider of interest to our readers.

**Special Notice.**—As the AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL is printed and ready for mailing on the last day of the month, correspondence, advertisements, etc., intended for insertion must be received not later than the 25th day of each month.

**Contributions.**—Articles relating to railway rolling stock construction and management and kindred topics, by those who are practically acquainted with these subjects, are specially desired. Also early notices of official changes, and additions of new equipment for the road or the shop, by purchase or construction.

**To Subscribers.**—The AMERICAN ENGINEER, CAR BUILDER AND RAILROAD JOURNAL is mailed regularly to every subscriber each month. Any subscriber who fails to receive his paper ought at once to notify the postmaster at the office of delivery, and in case the paper is not then obtained this office should be notified, so that the missing paper may be supplied. When a subscriber changes his address he ought to notify this office at once, so that the paper may be sent to the proper destination.

The paper may be obtained and subscriptions for it sent to the following agencies: Chicago, Post Office News Co., 217 Dearborn Street. London, Eng., Sampson Low, Marston & Co., Limited St. Dunstan's House, Fetter Lane, E. C.

An automatic signal application on the normally danger plan using semaphore signals and switch indicators and providing protection to trains by means of home and distant and advance signals at stations is the longest step in advance taken by railroad signaling in years, and we would direct special attention to the interesting description of the new work on the Illinois Central Railroad by Mr. W. J. Gillingham on another page of this issue.

The painting of cars by means of compressed-air spraying machines has been looked upon very conservatively by many car builders. They sometimes raise the objections of wastefulness of paint, inferiority of work and danger to the men from inhaling the fumes from the spray. The important improvements in railroad work often have some slight objectionable features at first and in many cases these disappear as a result of experience. It is believed that the merits of air spray painting are likely to survive criticisms and to place this process among the valuable improvements of recent times in car work. The ruling question in this case is that of cost, and Mr. H. G. MacMasters in a paper which is presented in part in this issue shows the saving to be 64 per cent. in painting a new box car over that of hand work, and the saving in truck work is even greater. In this comparison the cost of

brushes and the paint lost in the spraying is not considered, but the saving in labor is large enough to overbalance a considerable loss of paint. There has been trouble in some cases with the uneven drying of the sprayed paint, but this has been found to be remediable by careful mixing of the paint and by using the proper amount of japan and linseed oil as a reducer. We are informed in a communication by Mr. MacMasters, that he uses less paint when applied by the jet than when put on by the brush, and this disposes of the statement that the jet scatters so much paint that it is wasteful. He has repeatedly taken weights and measurements to compare it with brush work. To those who are still doubtful of the advisability of spraying careful consideration of the paper referred to is recommended.

Our English contemporary, *The Railway Magazine*, does us the honor to notice the paragraph in our October issue, commenting on the complexity of signals on English railroads and very courteously intimates that we would not have so many railroad wrecks if we did our signaling as thoroughly as the English do. Now thoroughness in signaling is absolutely necessary to safety, and we would be the last to slight its great importance, but we think our contemporary misunderstood us a little. We are among the greatest admirers and supporters of correct signaling, but we do not believe in using one more light or blade than is absolutely necessary to the safety of trains, and we repeat that the great number of signals used in English plants constitutes an argument for simple signaling.

The comparatively large number of recent elevator accidents directs attention to the character of the automatic clutch devices which are intended to prevent the falling of elevators when the gearing of the hoisting ropes breaks. In spite of the fact that good engineering talent is concerned in this branch of transportation there seems to be an opportunity to offer a suggestion to the effect that it is not safe to rely upon the action of an automatic device which does not operate frequently. One of the fundamental principles in railroad signaling requires a failure of the apparatus or sticking of the parts to give a danger indication, which directs attention at once to the apparatus and compels investigation. This ought to be brought into elevator practice in such a way as to render it impossible to use the elevator if the safety devices are not in working order. It is unquestionably easier to make this suggestion than to apply it, but this is believed to be the direction in which the safety devices of the future should be sought.

The trouble caused by the destruction of the records of any department of a railroad company is a calamity which must be experienced in order to be appreciated. A fire in the general office building of one of the Western roads recently consumed the entire office records of several departments, including that of the Chief Engineer, whose maps and plans had been prepared at great expense of money and effort. These may all be replaced, but records of the right of way, deeds and surveys cannot be replaced without going over the work from the beginning. It would cost less to provide a fireproof vault for such valuable property, and it is a matter for wonder that such precautions are not always taken. It is not unusual to find the tracings, drawings and valuable papers which have accumulated for years in the conduct of railroad business stored in frame buildings where, perhaps from thoughtlessness, perhaps for the sake of economy and immediate convenience, they are not protected in any way against loss by fire. This applies to mechanical as well as to other departments and such an example as the one mentioned ought to call attention to the true character of such so-called economy. Insurance cannot cover the loss of this kind of property and the best preventive is the provision of adequate vaults. They may usually be constructed without great expense. The road referred to may be depended upon to furnish an example of one that will be thoroughly equipped against such losses in future.

### The Anti-Scalping Movement.

War to the death seems to be the programme in regard to the iniquitous incubus, ticket scalping, and it is time that this nefarious business was absolutely done away with. It would not have lived so long if it had not had some strong support and as the props are one by one taken away the structure is rapidly falling. It seems as if the business would soon have no leg to stand on. The roads are and have been ready to redeem tickets which are not used, and in some sections even the much vaunted support of the organizations of traveling men has been lost to the scalpers. Pronounced action has been taken by them in the interests of legislation against scalping and in assisting in carrying out the laws. We have the lowest rates in the world and have also the very best service in the world, and why the passenger business of the country should so long have been allowed to be the feeding ground of a multitude of vampires is not easy to explain. With the influence of the Interstate Commerce Commission and the legislatures of 10 states as well as that of the Dominion of Canada all working in the same direction it is safe to predict that the death so long awaited is near at hand. The friends of anti-scalping laws and their enforcement owe much to the energy and persistency of Mr. George H. Daniels whose tireless efforts in the crusade have done much to make this type of thievery disreputable.

The chief patronage of the scalpers has come from commercial travelers, and the most encouraging action yet taken is that of the National Association of Merchants and Travelers, in which the organization is on record in positive terms urging Congress to pass the anti-scalping bill without delay. They say: "Ticket scalping is a burden from which the transportation companies ought to be relieved, in common fairness, and also the citizen who travels infrequently and is not posted as to rates of fare and the methods of the scalper, should be protected from fraud in the purchase of tickets which will not be honored for passage, and from the inducement to lying and forgery, as against public morals."

### THE PASSING OF THE WOODEN FREIGHT CAR.

Freight car construction in this country is now in a positive transition stage, owing to the rapid approach of the steel car age. In trucks, it may be said that wooden transoms have almost entirely disappeared, though there are some few roads whose car superintendents are so benighted as to use them on new cars. During the past year the wooden truck bolster has been the exception, and the majority of new cars have metal truck bolsters, either of cast-steel, pressed steel or of the various forms built up from angles, tees, channels and plates, and some malleable cast-iron truck bolsters have been placed in service. Large numbers of pressed steel trucks are now made, and at least half a dozen companies are extensively engaged in building metal freight trucks.

In the change from the wooden bolster to the metal one, a decided modification has been made in truck design, which places the springs inside the arch bars, suspending them from the cross channels. This method admits of a much shorter bolster, the length being reduced from over 7 to 5 feet, and the distance between supports from 6 feet 3 inches to 4 feet. A much lighter bolster can be obtained by this improvement. A composite bolster 5 feet long and 8 inches deep with two  $\frac{1}{4}$  by 8 inch plates sandwiched between oak planks, weighs complete with center plate and side bearings about 400 pounds. When made of cast-steel, the weight is 280 pounds; of malleable iron, 300 pounds and of pressed steel 320 to 365 pounds. As far as trucks are concerned, it may be said that current practice is to build them entirely of iron and steel.

As we approach the car body, the first thing above the truck, the body bolster is found to be rapidly changing from wood to iron. It is true that iron body bolsters made of  $\frac{1}{4}$  by 6, or 1 by 7 inch rolled bars, have been used for years, but they were so badly designed that they would not carry the load of even 40,000 pounds without excessive deflection and bending, thus throwing

too much of the weight on the side bearings. Some roads have rejected this form and substituted steel eye beams, while others have developed the bar iron bolster into a good design, making it of much greater depth and width, and using malleable iron for the filling pieces; but neither the eye beams nor improved bar iron body bolsters can long hold a place, when compared with the ideal designs in pressed steel, by the Schoen Pressed Steel Company and the Bettendorf bolster by the Cloud Steel Truck Company. The bolsters designed by these companies appear to be almost perfect in the disposition of the metal to secure extreme lightness with sufficient strength. Body bolsters built up of bar iron for 60,000-pound cars weigh as much as 780 pounds each, while those of pressed steel for the same capacity have been made as light as 500 pounds in one design and 350 pounds in another. It is possible that economy of material has been carried too far in some of these designs, and the metal is so thin in some parts that we doubt if it will resist corrosion and shock combined much over 10 or 12 years. This branch of car building is developing so rapidly and railroad methods are changing so radically that it may not be necessary to provide for over 12 or 15 years' service. At the end of that period 60,000-pound cars may be as obsolete as 30,000-pound cars are now, and it may be desirable to replace them with equipment of much greater capacity.

The upper framing of a box car of 40,000 pounds capacity is not very different from that of a 60,000-pound car. The upper work is principally for the protection of the lading, and is not intended to assist in carrying the load. With this understanding of the case, many roads have found it an easy matter to change cars of small capacity to those having 50 per cent. greater capacity by putting in good body bolsters and deep truss rods. The center sills of freight cars are the most vulnerable part of the underframing. It is an old standing rule of the Master Car Builders' Association that center sills must not be spliced, while other sills may be. The draft and buffing resistance is almost entirely on the center sills. For this reason they have received first attention when any improvement upon wooden sills has been attempted.

Wooden draft timbers have always been the source of most frequent failures, and the cause of most repairs on wooden cars, and a better foundation for the draft rigging has long been desired. This fact has naturally led to the design of wooden cars with steel center sills, to which the draft gear is securely fastened. Such a design with 10-inch channels weighing 25 pounds per foot has been worked out, and some few cars built from it, but an extra cost of about \$20 per car has prevented a more extended use of it.

Steel end posts for box cars have been extensively used by one or two roads for a number of years; and box and stock cars with upper and under framing of steel were built by the Harvey Steel Car Company previous to 1893. Many of them are still in service, but as they cost more than wooden cars, and the capacity was not increased, their only advantage is a longer life and less cost for repairs, items which railroad managers have not found sufficient reasons for increased cost of new equipment.

Malleable castings are rapidly coming into general use on freight cars, resulting in a reduction of 40 per cent. as compared with the weight of cast-iron formerly used. The common grey castings used on a box car weigh about 3,500 pounds and the reduction in weight by the use of malleable iron is 1,400 pounds. It is found that sections  $\frac{1}{4}$  and  $\frac{1}{2}$  inch thick in malleable iron are sufficient for most car castings which were formerly made  $\frac{1}{2}$  or  $\frac{3}{4}$  inch thick. The advantages of malleable iron are now so thoroughly realized that one or two car companies have found it necessary to build malleable iron foundries, and others will doubtless follow. The same is true of some foundry companies supplying grey iron castings to railroads for repairs.

Coming now to the weight and carrying capacity of wooden cars, we find in it the principal reason why they cannot be used economically, when a greater capacity than 60,000 pounds is desired. Freight cars of this capacity will be most economical for local merchandise for many years to come, for, as the country becomes more thickly settled, this kind of traffic grows larger.

For short hauls and cars only partly loaded, large capacity and corresponding dead weight are neither desirable nor economical. For long distance grain haul, a car of larger capacity will be found economical and it will probably be built with a steel underframe and wood upper structure. For coal and ore 80,000 and 100,000-pound capacity steel cars will rapidly come into use. A steel car weighing 28,000 pounds will carry 80,000 pounds and one weighing 34,000 pounds will carry 100,000 pounds. Compare these weights with wooden cars of high capacity. The Chicago & Eastern Illinois Railroad has recently put into service a number of 80,000-pound capacity coal cars built with wooden sills and coal sides and they weigh 32,500 pounds, or 7,500 pounds more than a steel car of equal capacity. A coal car built by the Fort Wayne road for 70,000 pounds capacity weighs 35,000 pounds, the dead weight being just one-half the paying load, and 10,000 pounds more than a steel car having 10,000 pounds greater capacity. A coal car of 100,000 pounds capacity, with steel underframe and wooden box, has been built for the Erie Railroad by the Michigan Peninsular Car Company. The weight of this car is 40,000 pounds. The Schoen steel car, of similar capacity, weighs 34,100 pounds, a difference of 6,000 pounds in favor of the all-steel car. Tabulating the above to show the ratio of light weight to carrying capacity we have the following for coal and ore cars:

Material.	Capacity.	Light Weight.	Ratio of light weight to carrying capacity.
Wood.....	60,000 pounds.	35,000	41.6 per cent.
Wood.....	70,000 "	35,000	50 " "
Wood.....	80,000 "	32,500	40 " "
Steel.....	80,000 "	28,000	35 " "
Steel underframe.....	100,000 "	40,000	40 " "
Steel.....	100,000 "	34,000	34 " "

The above figures show plainly why the wooden car for coal and ore must go, and it is passing rapidly. We see no reason why steel underframes will not replace wood for large capacity grain cars.

We have thus described the passing of the wooden car, and in a future article will take up the advantages of steel cars more in detail.

#### EFFECT OF BRAKEBEAM HANGING ON BRAKE EFFICIENCY.

It is regretted that space is not available to publish in full the paper presented by Mr. R. A. Parke on the Effect of Brakebeam Hanging on Brake Efficiency, recently read before the New York Railroad Club.

Mr. Parke first raised the question of the advisability of using a braking power of 70 per cent. of the weight of cars in freight equipment, and 90 per cent. in passenger equipment; brake power being the ratio between the aggregate pressure of the brakeshoes upon the wheels and the weight of the car upon the wheels. Pressures of 70 per cent. of the weight of the cars are commonly used in freight service, while 90 per cent. is commonly employed in passenger service. The power on freight equipment ought to be increased in order to render more to it available when the cars are loaded. The ratio is, of course, lower when loaded than when empty, and the consideration of these questions emphasizes the importance of improving the conditions, particularly of freight brakes, and every one must admit the value of any improvement in the means for increasing the ratio on passenger cars. The paper showed that even with the present pressures there is more tendency to slide the wheels of freight cars than those of passenger cars, in spite of the much greater brake power of the latter equipment. This was due to several causes, among which was the fact that the shorter length of the freight cars permitted inertia to act in a way to tend to tip the car forward in stopping so as to cause the pressure to be much greater on the front wheels than on the rear ones of each truck.

The amount of this transfer is not known, but it is perfectly clear that some transfer does take place, as may be seen by watching a truck of a passenger car just as it is coming to a stop at a station. The reason for the transfer is that the adhesion of the rail acts as a retarding force when the brakes are applied, and as this retarding force is applied at the lowest point

on the wheels a tendency to tip about the center of gravity occurs, which causes the transfer of weight. This tipping of the trucks throws some of the weight that ordinarily is carried on the rear wheels to the front wheels, and relieving the weight on the rear wheels tends to make them slide more easily and reduces the braking power to that dependent upon the weight that remains upon the wheels that carry the lightest load. It is necessary to use less pressure on the rear wheels as long as equal pressures are used on all the wheels in order that the pressure may not be too great for the rear wheels and cause them to slide.

The purpose of the paper may be stated to be to provide a plan whereby the brakeshoe pressure may be proportioned to the actual pressure of each of the wheels upon the rails. It was incidentally intended to provide means whereby the tendency for the car and the truck to tip during the stop might be reduced. It is evident that a solution of these problems would render it possible to greatly increase the efficiency of the brakes.

The solution found may be briefly stated to be the use of inside hung brakebeams and of hangers inclined away from the wheels, the tendency of which is to decrease the pressure of the brake shoes on the rear wheels and increase the pressure of the shoes on the front wheels. The sketches of trucks fitted with beam hung in this way, presented in the abstract of the paper, will make the reason plain, and will show the effect of the brake hangers in carrying components of the thrust of the brakeshoes to the truck frame, the reactions of which bring about the increase of pressure on the shoes of the front axle and decrease the pressure on the shoes on the rear axle. It is also evident that these reactions in the hangers will tend to a certain extent to correct the tendency for the trucks to tipped by inertia. It should be noted that reversing the motion of the train reverses the conditions and the hanging that is correct for one direction is equally correct for the other.

The possible effect of the hangers to exaggerate the tilting of the trucks may be seen in a passenger truck when the brakes are outside hung. In this case the forward hanger pulls the front end of the truck frame down and the rear hangers tend to push the rear end up. From this it will easily be seen that the inside hanging will reverse these thrusts.

The advantages offered by these suggestions by Mr. Parke are the following: The release springs become unnecessary because the brakebeams will of their own weight tend to fall away from the wheels; the efficiency of the brakes will be increased in the emergency applications from 10 to 15 per cent. without danger of sliding the wheels; the distance in which a passenger train, going at a rate of 60 miles per hour, can be stopped, will be decreased by about 200 or 250 feet; and these improvements may all be had without any increase of the expense of building or maintaining equipment.

We would like to dwell upon many of the very interesting points mentioned by the author of the paper, but cannot do so here, and must content ourselves with this brief summary. If these paragraphs induce our readers to study the paper itself our purpose will be carried out. We believe it to be the most important contribution to the literature of the air-brake since the publication of the results of the Burlington brake tests.

#### NOTES.

The conversion of old consolidation locomotives into eight-wheel switching engines is practised at the Mt. Clare shops of the Baltimore & Ohio. The pilots are removed, the front ends of the frames are cut off and the front truck is eliminated.

The Chicago & Northwestern is making extensive additions to its block system and now has it in use between Boone and Clinton, Ia. Block signals are now in use between Chicago and Minneapolis, and very soon the road will have it in operation on 800 miles of its line. The blocks average four miles in length and the system is operated by the station operators, like that of the Chicago, Milwaukee & St. Paul Railway.

In tearing up a siding on the Straitville division of the Baltimore & Ohio Railroad recently the section men discovered that

several of the rails had been made in 1863. Subsequent investigation revealed the fact that these rails were part of a lot that were bought in England during the war at a cost of \$125 per ton in gold. The rails were still in very fair condition and for light motive power would last ten years longer.

The average fare per passenger for the busy hours on the Metropolitan Traction Company's lines in New York City is shown by President H. H. Vreeland in a paper read at the Street Railway Convention to be but 2½ cents. This is for the hours when crowds are going and coming to and from their work and the low rate is due to the large numbers of transfers. One out of three passengers is transferred and a ride of 25 miles may be had for one five cent fare.

Much gratification is expressed at the War Department over the report received of a test at Sandy Hook of the new Crozier-Buffington 12-inch disappearing gun carriage. The test was for rapidity alone, as the carriage had successfully passed other requirements. No carriage of that size had been tested before, and there was some doubt as to its utility. Ten rounds were fired in 16 minutes and 57 seconds under adverse conditions. A high wind and a beating rain interfered with the test, and in addition the gunners were not familiar with the workings of the new carriage.

The new Heilman electric locomotive was tested Nov. 13, before a great gathering of European railway men. The trial trip was from Paris to Nantes, over the Western Railway. The train hauled by the locomotive weighed about 200 tons. The trial was intended chiefly to illustrate the reduction of vibration and the regularity of movement of the new machine. This was demonstrated, but the speed did not exceed eighteen miles an hour. The directors of the railway company are reported to be pleased with the success of the locomotive, and it is stated that they have decided to adopt it. We doubt the adoption or the satisfaction.

The engine columns of new battleships have been made of nickel steel and according to a recent report by Chief Engineer E. R. Freeman, U. S. N., the nickel steel was preferred on account of its toughness, in spite of the fact that the tests showed high carbon steel used in similar columns to have somewhat better physical characteristics than the nickel steel. A severe cold bending test told in favor of the nickel steel, although the elongation and reduction of area were in favor of the high carbon steel. The nickel steel columns tested were all accepted, while some of the others were not because of defects which the annealing failed to overcome.

The use of wood in the construction of German naval vessels is restricted as far as possible owing to the experience of the battle of the Yalu. Herr A. Dietrich, quoted in the *Proceedings* of the United States Naval Institute, says that in the new German ships wood is used only in a few minor parts. The decks and ceilings are of metal, protected by linoleum or cork where necessary. The chart houses and captain's rooms on the bridges are all of steel, and aside from the furniture of the officers' quarters and the shelving in the ammunition rooms there is very little wood about the ships. Signal masts and flag poles are of steel, and wood is not used for hand rails. The object is to increase the fighting capacity by rendering the ships less likely to burn, reducing the dangers of flying splinters and reducing the weight of the ship so that more weight may be put into ordnance and armor.

The practice adopted by the French navy for the preservation of boilers not in use is different from that generally in vogue, and it is worth at least making a note of. They seem to take the bull by the horns. Instead of emptying the boiler, they fill it completely full of fresh water, and then add to the water a certain amount of milk of lime or soda. The solution used is not so strong for boilers with small tubes; it is intended to be just sufficient to neutralize any acidity of the water. Particular attention is given to the outsides of the tubes, if they are not to be used for a long time. They are painted with red lead or coal tar

as far as they are accessible, and for the rest a protective coating is obtained by burning tar, the smoke of which will form a coating of soot. Besides this, the boiler casing is closed and kept airtight, after some quicklime has been placed inside.—*American Machinist*.

A combination of the alternating and direct current systems for electric light and power circuits for large cities is advocated by Louis A. Ferguson in a paper before the Association of Edison Illuminating Companies. The advantages to be derived are the saving of two-thirds of the cost of fuel and more than that proportion of the cost of labor by removing the steam plants from sub-stations. A large central station plant, with alternating current distribution and transformers at the sub-stations, is advocated as a much better plan than that now in general use. The labor charge at the central station need not be increased, and by this method of distribution the most satisfactory means for providing for a fluctuating load-line may be found. The Edison Electric Illuminating Company of Brooklyn has adopted this method of distribution for the development of outlying territory, and is now installing apparatus on a large scale.

The case of the engineers in the navy, to which we have given so much attention, is in the hands of a board consisting of the following officers: Capt. W. T. Sampson, Commander of the battleship *Iowa*; Capt. A. S. Crowninshield, Chief of the Bureau of Navigation; Capt. Robley D. Evans, of the Lighthouse Board. Capt. Alexander H. McCormick, Commander Joseph N. Hemphill, Lieut.-Commander Richard Wainwright and Lieut. Albert L. Key, representing the line. Engineer-in-Chief George W. Melville, Chief Engineer Charles W. Rae, of the *Iowa*; Chief Engineer George H. Kearny, and Past Assistant Engineer Walter M. McFarland are the staff representatives. This board, with Assistant Secretary Roosevelt as its president, came to an agreement Nov. 8, which, when perfected, is to be put into the form of a bill and presented to Congress with the endorsement of the Secretary of the Navy. This action is understood to be along the lines of a plan reviewed in a recent editorial in this journal.

A novel proposition was made not long ago to the Receivers of the Baltimore and Ohio Railroad. This road has a branch running from what is known as Alexandria Junction, near Washington, to Shepherd's on the Potomac River, where a car ferry is operated in connection with the lines leading south from the capital. A professor of an eastern college desired to lease this short stretch of track for the purpose of educating young men in practical railroad work. In his letter he explained that he thought there was a wide field for bright and energetic boys who could be thoroughly well grounded in the practical side of railroading provided they could be educated on a regular line of road. He believed that by the employment of veteran railroad men as teachers that the boys could profitably spend two or three years working as trainmen, firemen, engineers, switchmen, station agents, and in other capacities required in the railroad service. As this branch is of considerable value, the Receivers were compelled to decline the offer.

Improvements on the Monon have been completed, the result of which is a material increase in the weight of trains which may be hauled over the road. These improvements consisted of the elimination of curves and the adjustment of grades at three places, the most important work being at Cedar Lake, Ind. Here five curves were rectified, one of one degree, three of two degrees and one of three degrees having been replaced by tangents and one one-degree curve, also a curve of five degrees and thirty minutes was reduced to three degrees. Instead of a series of grades ranging up to 1.66 feet to the 100 feet in each direction, the profile has been converted into a practically uniform grade in one direction with a maximum of .47 in 100 feet, or .25 feet per mile. One dip formerly having grades of 1 foot in 100 in one direction and 0.6 in the other is entirely removed and replaced by a grade of 0.09 per 100 feet, or 4.75 feet per mile. By these changes, which were planned by Mr. Ferd Hall, Chief Engineer

of the road, an increase of the possible weights of trains of from 20 to 40 cars per train has been obtained.

The largest power plant in the world will be erected by the Metropolitan Street Railway Company of New York for the purpose of furnishing power for the 218 miles of its street railroads. The plant will comprise 11 cross-compound condensing engines of 6,600 horse-power each and 87 water tube boilers of 800 horse-power each. Storage capacity for 9,000 tons of coal will be provided, the coal being stored in the upper story of the power-house so that it may be delivered to the boilers by gravity. The current from the power-house at 6,000 volts will be carried to sub-stations where static and rotary transformers will convert it to 550 volt currents for the conduits. The total horse-power of the plant will be over 70,000, which is far in excess of that of any steam plant now in existence. This will be a most interesting example of power distribution from a central station and much is expected from the consolidation of the power units of the four present stations into one. The cable system will be replaced by electricity and the underground trolley will be used for the whole of the system.

Rumors of pretty nearly every possible and impossible calamity that could influence the prices of stocks to decline were circulated the first week in November and among them was one to the effect that our country was soon to be invaded by the armies of Spain and we suspect the authorship of the following bogus dispatch which appeared in the New York *Sun* may be traced to a waggish broker who enjoys the acquaintance of Mr. George H. Daniels, General Passenger Agent of the New York Central. "Washington Special.—It is understood that Señor De Lome has telegraphed to New York for a time table of the New York Central & Lake Shore railroads, as he wishes to know which will be the most convenient train for the Spanish Army to take from New York to Chicago. It is understood that the New York Central officials, with a spirit of patriotism which other roads will do well to follow, have refused to send the time table. This will necessitate the Spanish Army going to Chicago via the Erie Canal. If cold weather sets in within the next few weeks, the canal will be frozen, and the Spanish Army prevented from reaching Chicago. This should have a good effect on the Granger stocks."

The improvements on the main line of the Baltimore & Ohio, west of and between Martinsburg, W. Va., and North Mountain, were completed November 1. They cover a distance of nearly four miles, starting three miles west of Martinsburg, and extending some distance west of Myers Hole, which is near the North Mountain station. At Myers Hole the line was changed, taking out some very objectionable curvature, and the roadbed was raised nearly 15 feet, eliminating two grades of 42 feet per mile, which came together at Myers Hole and substituting therefor an almost level track. This point on the road has always been a dangerous one and many freight wrecks have occurred there. Apart from doing away with the dangerous feature of two sharp down grades coming together, as was the case in this instance, the saving in operation of the road by the change will be very large, as it enables the tons per train to be greatly increased and reduces the liability to accident to the minimum. At Tablers, the roadbed has been lowered about 13 feet, and the same at Tabbs, besides taking out objectionable curvature and reducing the rate of grades at these points from 42 feet per mile to 10 feet per mile, thus increasing the number of tons that can be hauled per train. Though these improvements have cost quite a sum of money, the expenditure is fully justified by the great saving in the cost of operation.

Old windmill gearing was the subject of a note recently presented by Mr. C. W. Hunt to the American Society of Mechanical Engineers. The gearing usually consists of a face wheel of about 10 feet pitch diameter, into which a small lantern wheel about 23 inches in diameter meshes. Mr. Hunt said: In 1889 I visited a windmill in Holland with gearing similar to the Nantucket mill, which had been built 60 years before. The face wheel teeth were being renewed, and the owner informed me that the first set

of teeth were replaced 30 years ago, and as these teeth had been in service 30 years he was again renewing them, evidently considering the "life" of gear teeth as 30 years. They were also renewing the main shaft, which had been in since the mill was built. The mill was used for grinding grain, and ran day and night, probably 18 to 20 hours per day for the entire time. The gear teeth were greased with tallow. The small wear of the teeth in service where the working pressure must be quite large for wood surfaces may be accounted for by their elasticity. The teeth of the face wheel, and especially the long rundles of the lantern wheel, are decidedly elastic, and when the pressure of the teeth is great they spring enough from the geometric lines to prevent all sliding of the surfaces in contact during the time that the pressure is great. The sliding of the surfaces takes place only at the beginning and ending of the tooth action, when the pressure is comparatively light.

The annual report of the General Superintendent of the railway mail service shows that at the close of the year there were 1,164 railroad postoffice lines, manned by 6,854 clerks; 33 electric and cable lines, with 102 clerks; 42 steamboat lines, with 57 clerks; making total number of lines 1,239, and total number of clerks 7,013. In addition to these there were 311 clerks assigned to duty at important junctions and depots, and 238 detailed to clerical duty in the various offices of the service, making a grand total of 7,562 clerks. The miles of railroad covered by railway postoffice car service was 154,225; of electric and cable, 303; and of steamboat lines, 7,459. The grand total of miles traveled of all classes of service was 282,830,031. There were 654 whole cars in use and 173 in reserve, and 2,026 apartments in cars in use and 540 in reserve. The number of pieces of all classes of mail matter distributed on the cars during the year was 11,571,540,680 exclusive of registered matter and city mail. Of registered matter there were 16,256,663 pieces in all. The amount of city mail distributed for stations and carriers during the year aggregated 462,469,640 pieces. The increase of ordinary mail handled over the previous year was 3.7 per cent. A comparative table covering a period of 10 years shows that there has been an increase in amount of mail handled of 77.2 per cent. and an increase in the working force of 48.6 per cent.

The provision of car sheds for housing passenger cars was strongly urged by Mr. J. A. Gohen, of the C., C. & St. Louis Railway, in a recent paper before the St. Louis Railway Club. Among the advantages urged in their favor was the protection of the equipment from the weather, and in discussing the subject Mr. G. W. Rhodes suggested that there was no need of the fine finish put upon the outside of cars, and that it would be better to provide them with such finish as would withstand the weather without the necessity of housing. There was no more reason for giving a piano finish to the outside of cars than for treating houses in the same way. This may make car painters squirm, but the suggestion is based upon good business principles. In this connection it is interesting to note to what extremes the matter of piano finish is carried on English cars. The *Railway Magazine* (England) states that the famous chocolate and white cars of the London & Northwestern receive no less than 16 coats, distinguished as follows:

Three coats of "white priming" (white lead, linseed oil and turpentine).

Four coats of "filling up."

One coat of red staining. This shows any surface inequalities, and the whole has to be rubbed down with pumice stone and water until not a particle of red remains.

The other coats are distributed as follows:

#### PANELS—WHITE.

Three coats of lead.  
One coat of Kremnitz white.  
One coat of enamel.  
Three coats of varnish.

#### BODY—CHOCOLATE.

Two coats of lead.  
One coat of brown.  
One coat of lake (carmine, a very expensive color).  
One coat of enamel.  
Three coats of varnish.

## Personals.

Mr. C. J. Snook has been appointed General Manager of the Texarkana & Fort Smith.

Mr. Edwin L. Moser, Mechanical Engineer, Philadelphia & Reading, at Reading, Pa., for the past six years, has resigned.

Mr. F. J. Ferry, Master Mechanic of the Louisville, Henderson & St. Louis, died at Cloverport, Ky., Nov. 4, at the age of 52 years.

Mr. A. A. Patterson, Jr., President of the Milwaukee, Benton Harbor & Columbus, has also been chosen President of the South Haven & Eastern.

Mr. Henry W. Gays, General Manager of the Chicago, Peoria & St. Louis, has been appointed General Manager of the St. Louis Chicago & St. Paul also.

Mr. A. S. Bosworth has been appointed Purchasing Agent of the Maine Central, with office at Portland, Me., and the office of Supply Agent is abolished.

Mr. W. J. Miller has been appointed Master Mechanic of the Southern Division of the Kansas City, Pittsburg & Gulf, with headquarters at Shreveport, La.

Mr. Joseph Billingham, Master Mechanic of the Baltimore & Ohio at Garrett, Ind., has been appointed Master Mechanic of the Pittsburg Division at Glenwood, Pa.

Mr. Samuel Thomas has been elected Vice-President of the Charleston & Western Carolina, with headquarters at Augusta, Ga., to succeed Mr. W. A. C. Ewen, resigned.

Mr. R. C. Fraser, late of Fraser & Bailey, railroad supplies, has just been appointed Eastern representative of the Schoen Brake-shoe Company, with offices at present in Boston.

Mr. T. L. Dunn has been appointed Chief Engineer of the Maine Central, with office at Portland, Me., and will have charge of all matters relating to maintenance of way, bridges and buildings.

Mr. J. G. Livingston has resigned as Purchasing Agent of the Lexington & Eastern to accept the position of General Superintendent of the Interoceanic Railroad of Honduras, Central America.

Mr. W. J. Craig, heretofore General Freight and Passenger Agent of the Charleston & Western Carolina, has been appointed General Manager of the same road, with headquarters at Augusta, Ga.

Mr. W. White, Jr., Assistant General Foreman of the Pennsylvania shops at Wellsville, O., has been appointed General Foreman of the Illinois Central shops at Freeport, Ill. He takes the new position Dec. 1.

Mr. C. F. McDermott, General Foreman of the Baltimore & Ohio shops at South Chicago, Ill., has been appointed Master Mechanic of that road at Garrett, Ind., to succeed Mr. Joseph Billingham, transferred.

Charles W. Reiff, Traveling Passenger Agent of the New York Philadelphia & Norfolk, died at his home in Philadelphia from typhoid fever Nov. 9. Mr. Reiff was 39 years old and had been in the service of the company for nearly 20 years.

Mr. C. B. McCall has resigned as General Manager of the Litchfield, Carrollton & Western, and the office has been abolished. Mr. T. W. Geer, formerly Trainmaster, has been appointed General Superintendent, with headquarters at Carlinville, Ill.

Mr. M. F. Bonzano, General Agent for the Receiver of the Columbus, Sandusky & Hocking, has been appointed Superintendent and Chief Engineer of that road, with office at Columbus, O., and the position of General Agent for the Receiver has been abolished.

Mr. J. B. Braden, formerly Assistant Superintendent of Motive Power and cars of the Wheeling & Lake Erie, has been appointed Superintendent of Motive Power and Cars of that road, with headquarters at Norwalk, O., to succeed O. P. Dunbar, deceased.

Mr. J. E. Galbraith, who has been appointed Traffic Manager of the Cleveland Terminal and Valley Railroad Company, with headquarters at Cleveland, will also be the General Agent of the Baltimore & Ohio at that point. These two positions were formerly held by Mr. L. Rush Brockenbrough, who is now General Freight Agent of the Baltimore & Ohio lines west of the Ohio River, with headquarters at Pittsburgh.

Mr. George W. Ristine, Receiver and General Manager of the Colorado Midland, was on Oct. 26 chosen President of the re-organized company, which took charge of the property Nov. 1. Mr. Ristine was appointed Receiver of the road May 1, 1895, and for three years previous to that date was General Manager of the United States Car Company at Chicago. He was formerly General Manager of the Erie Dispatch.

Mr. E. W. Grieves has resigned as Superintendent of Car Department of the Baltimore & Ohio to engage in other business, and the office has been abolished. The duties will be assumed by Mr. Harvey Middleton, General Superintendent of Motive Power. Mr. Grieves has been with the B. & O. since 1884 as Master Car Builder and Superintendent of Car Department, and was formerly for 16 years with the Harlan & Hollingsworth Company, of Wilmington, Del., as Chief Draughtsman and Foreman.

Mr. Oliver P. Dunbar, Superintendent of Motive Power and Cars of the Wheeling & Lake Erie, died suddenly at Norwalk, O., Oct. 30, of apoplexy. He was born at Hartland, Vt., Jan. 9, 1835, and had been in railway service since Oct. 24, 1854. His first work was as fireman on the Cleveland & Toledo, and after that he was, until September, 1858, Machinist and Locomotive Engineer on the same road. He served six months as Locomotive Engineer on the New Orleans & Jackson. For 15 years he served in the same capacity on the Cleveland & Toledo and the Lake Shore roads. In July, 1875, he was appointed Master Mechanic of the Canada Southern and remained in that position until Feb. 1, 1883, when he became General Master Mechanic of the Wheeling & Lake Erie. He was appointed Superintendent of Motive Power and Cars of the same road last April.

Thomas Doane, C. E., who built the famous Hoosac Tunnel, and had charge of many other important engineering works, died at Townsend, Vt., Oct. 23, at the age of 76 years. He was born at Orleans, Mass., in 1821, and was educated at the Andover Academy. After graduating, he entered the office of Samuel M. Felton, of Charlestown, Mass. From 1847 until 1849 he was resident engineer of the Cheshire Railroad at Walpole, N. H. In December, 1849, he returned to Charlestown and opened an office, where he carried on his profession of civil engineering and surveying. In 1863 he was appointed Chief Engineer of the Hoosac Tunnel. He located the line of the tunnel and built the dam in the Deerfield River to furnish water power. In 1869 he went to Nebraska, where he built 240 miles of the extension of the Chicago, Burlington & Quincy. In 1873 he was reappointed Consulting Engineer of the Hoosac Tunnel, and on Feb. 9, 1875, upon the opening of the tunnel, he ran the first locomotive through it. In 1879 he was appointed consulting and acting chief engineer of the Northern Pacific for one year, and since the expiration of that time he has been located at Charlestown, Mass.

## Books Received.

A FIELD MANUAL FOR RAILROAD ENGINEERS. By J. C. Nagle, M. A., M. C. E., Professor of Civil Engineering in the Agricultural and Mechanical College of Texas. First edition, 12mo, morocco flap. New York, 1897: John Wiley & Sons. Price, \$3.

This book is intended for field use, and in order to render reference to its information easy a uniform notation has been adopted. Greek letters have been avoided except in a few cases, and a single letter has been used to indicate an angle. The figures have been

made self-explanatory as far as this could be done, and the necessary explanations have been reduced to a minimum. The arrangement of algebraic equations by which each has a distinct line permits of reading them easily. The author assumed a knowledge of geometry and trigonometry on the part of the reader and used higher branches only in the derivation of a few formulas for transition curves. The book was intended for use in the class-room as well as in the field. The following is the arrangement of the chapters:

Chapter I. gives briefly the general method of making Reconnoissance; Chapter II. treats of Preliminary Surveys; while Chapter III relates to Location.

Chapter IV., on Transition-curves, follows the method adopted by Professor Crandall, and enables one to locate the transition-curve with rigid accuracy where such is necessary. Approximate methods are also given by means of which the curve may be as easily located as any of the more limited easement curves ordinarily met with.

Chapter V., on Frogs and Switches, contains all that is necessary for their location. The formulas have been arranged to give the desired quantities in terms of the frog number whenever the resulting equations would be easier of application than the trigonometric ones usually given. The turnout tables are unusually full and give not only the theoretical lead but the stub lead as well, from which the practical lead can be at once found when the length of switch-rail is known.

Chapter VI., on Construction, tells how to set slope-stakes, and gives simple methods for computing areas and volumes either directly or by use of tables. A short table of prismatic corrections is given for end sections level, and also a formula for three-level sections, by means of which a suitable table may be computed if desired.

The tables at the end of the book have been arranged with a view to ease of reference. A table gives the functions of a one-degree curve, other tables give the logarithmic and the natural functions. The degree curve is defined with reference to a unit chord shorter than 100 feet for curves of over seven degrees and the curve tables are made to agree with this definition. Tables of co-ordinates of transition curves and deflection angles. In the tables vertical lines have been omitted wherever practicable, which renders it easier to consult them. All the trigonometric tables are given to five places, and the others were carried out to as many places as their character demanded. A number of convenient tables are given at the end of the work such as slopes for topography, rise per mile of various grades, material required for one mile of track and conversion tables for metric and English measures. It is a convenient book and is an improvement upon others which have been brought out for similar purposes.

THE IMPERIAL UNIVERSITY CALENDAR, 1896-97. Imperial University of Japan, Tokio. Published by the University, 1897.

THE ENGINEERING MAGAZINE, published by Mr. John R. Dunlap, has inaugurated a European edition published simultaneously with the American edition. The scope of the magazine is not to be limited by either national or geographical boundaries, but, as the prospectus puts it: "The world is its field and to make the world's best engineering practice available everywhere is its central purpose." Ten special articles and the engineering index will appear simultaneously in both editions. The editorial department of the foreign edition will be in charge of the following engineers: Civil Engineering, Mr. H. Graham Harris; Electrical Engineering, Mr. James Swinburne; Mechanical Engineering, Mr. W. Wonby Beaumont, and Mining and Metallurgy, Mr. David A. Louis. These departments will contain comments upon topics of current interest, and will be conducted after the manner of the corresponding departments of the American edition. Messrs. Charles B. Going and H. H. Supplee are the editors of the American edition. We wish our contemporary success in the new enterprise.

#### Trade Publications.

THE COMPOSITE BRAKESHOE COMPANY has issued a 16-page pamphlet containing testimonials from railroad officers in New England having used the composite brakeshoes. The names of prominent roads outside of New England using these shoes exclusively might have been added, but the list includes only what may be termed home roads. Among them are many electric lines.

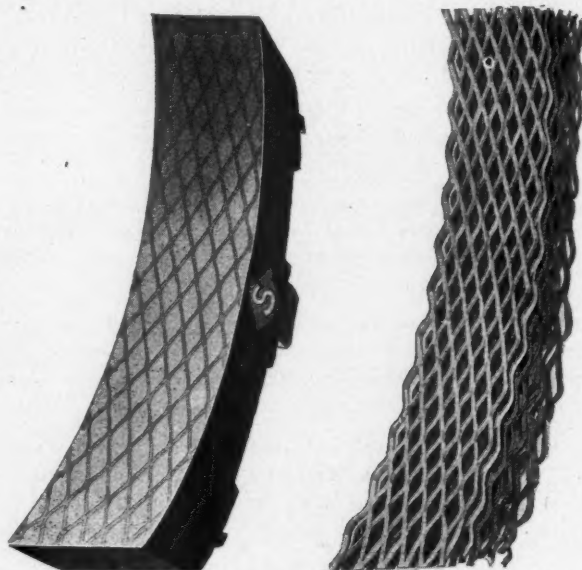
BRYANT SAWING MACHINES.—The Q & C Company, of Chicago, present a general idea of the different sizes and capacities of their

cold sawing machines in an illustrated standard size (9 by 12 inches) pamphlet of 24 pages. Sixteen different sizes and styles of machines are shown, and information is given with regard to saw blades. There are two long lists of users of this machinery, which include many well-known railroads and manufacturing concerns.

SIXTY MINUTES BETWEEN PHILADELPHIA AND ATLANTIC CITY is the title of a neat folder recently issued by the Philadelphia & Reading for the purpose of stating facts and figures regarding the fast train which ran between Philadelphia and Atlantic City last summer. An engraving gives a reproduction of a photograph of the train, and the folder gives in concise language an account of the train, details of weight and information about the cars and the locomotive, as well as a detailed record of the time made by the train during July and August. Those who desire to preserve this information in convenient form will be glad to send for a copy of the folder. Mr. Edson J. Weeks is the General Passenger Agent of the company, with office at Philadelphia.

#### Friction Tests of "Diamond S" Brakeshoes.

Our illustrations show the construction of the new "Diamond S" brakeshoes recently placed upon the market by the Sargent Company. The engravings show the construction to be a body of cast-iron surrounding a bundle of strips of expanded metal, cut to the proper shape and placed in the mold before the pouring. The result is a solid casting with a network of soft steel, running from end to end. One of the illustrations shows the bundle of expanded metal, another shows a cross-section through the shoe exposing the ends of the meshes and the third gives a view of the wearing



The "Diamond S" Brakeshoe and Steel Strips.

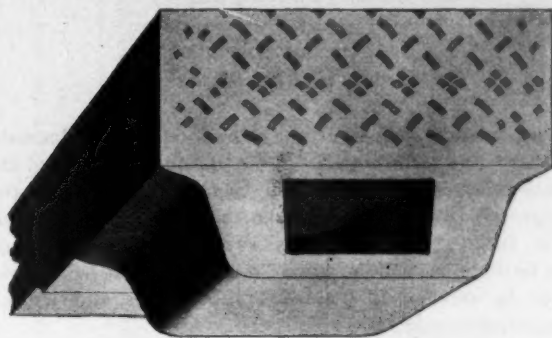
surface of the shoe, in which the cast iron is divided into diamonds by the expanded metal.

An excellent and uniform quality of soft steel is required by the expanding process and as the cast-iron brakeshoe mixtures used by this company are from a standard formula every precaution is taken to insure uniformity in the wearing surfaces, and this idea is carried out in the new shoe to a greater extent than before. It is evident that uniform breaking forces are not to be obtained without uniformity in the surfaces and with a combination of a truly quick action brake with a tight-holding brakeshoe good results in power breaking may be expected.

One effect of this construction is to present a constantly changing wearing surface. The wearing away of the shoe presents a change in the lateral position of the steel-rubbing surfaces, an effect never before produced. In the operation of this shoe the soft steel portions restrain the particles of cast-iron, preventing them from being removed by the wheel until the steel barriers are slightly worn down, whereupon the particles are carried on to the next diamond; this results in increased friction and increased durability, not before expected from a combination consisting so largely of cast iron. The shoe under consideration is the result of long study and of an effort to secure a combination of steel and soft cast iron minutely subdivided for the purpose of securing the maximum

friction effect, a coefficient of friction as nearly as possible half way between those of soft cast iron and soft steel being desired.

It is not necessary to dwell upon the advantages to be gained by improving the efficiency of air brakes. It is enough to say that any method of shortening the distance in which a train may be stopped will be welcomed, and the recent Garrison's accident may



Etched Section Through Shoe.

be cited as an instance of splendid work done by the quick-action brake, and had it not been for this brake the results of the accident would have been frightful beyond expression. There is every reason for encouraging efforts to improve in these directions and for this reason and also because of their general interest, we herewith present extracts from some interesting tests upon these brake-shoes recently made by Mr. J. C. Whitridge on the laboratory brakeshoe apparatus of the Master Car Builders' Association at Wilmerding. These results were received just as we were going to press, which prevents us from commenting upon them as we would like to do, but as the work was done and the results are tabulated as in the tests for the association, comparisons may easily be made. The report contains a detailed description of the apparatus employed, which we omit because our readers are already familiar with it.

The results of these tests together with service record show the new shoe to be greatly superior to the plain cast iron shoe in endurance. It has also been demonstrated that it will not harm steel tires. The greater endurance which equals that of hard shoes, which have long life at the expense of friction, seems to be due chiefly to the interference introduced by the soft steel fibers to the grinding away of the cast iron; the toughness and ductility of the soft steel disposed in this way holds up the friction while preventing wear. The report of the tests speaks for the superior friction effects of the new shoes.

#### FRICITION TESTS.

Outline of Tests.—The direct object in making the tests was first to determine, under several sets of conditions, the co-efficients of friction of "Diamond S" brakeshoes cast from both soft and hard iron; second, to obtain results under similar conditions for soft and hard plain iron shoes cast at the same time and from the same metal as the "Diamond S" brakeshoes; third, to have the conditions of initial speed, braking pressure and methods of conducting the tests the same as those used in the Master Car Builders' Association tests, made and reported upon in June, 1896. In this way the results of the present test can not only be fairly compared one with another, but also a comparison can be made directly with the results of the M. C. B. laboratory tests, where various brakeshoes were tried.

Such tests were made as would for all practical purposes, and without extending the work unnecessarily, show the relation which the friction of the "Diamond S" brakeshoes bear to the friction of other brakeshoes, under conditions previously selected by the M. C. B. Committee as representing passenger and freight service.

#### SCHEDULE OF TESTS—BOTH STEEL-TIRED AND CHILLED WHEELS.

Soft and Hard "Diamond S" Brakeshoes.			
Speed, miles per hour.		Braking pressure, pounds.	
65.....	10,733	6,750	2,794
40.....		6,750	2,798
Soft and Hard Plain Cast iron Brakeshoes.			
40.....		6,750	2,798

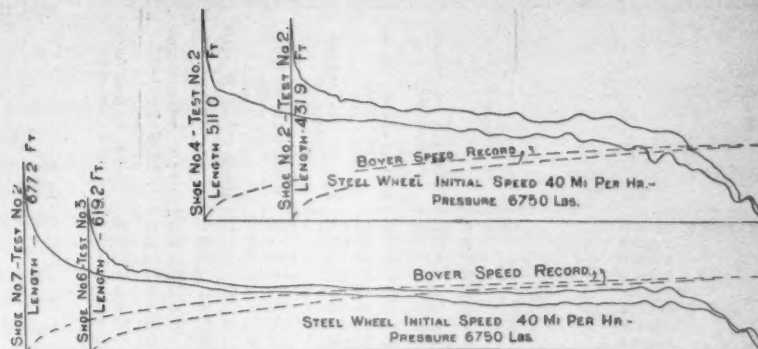
The braking pressure, 10,733 pounds, represents heavy passenger service, the pressure 2,798 pounds ordinary freight service, while the pressure 6,750 pounds corresponds to medium passenger service.

Brakeshoes.—The brakeshoes furnished for these experiments were of the usual form, to fit the M. C. B. standard head, 13½ inches in length by 3½ inches wide. The face of each shoe was turned or ground to fit the test wheels which are without taper and approximately 33 inches in diameter. The shoes were numbered from one to eight, as follows:

- Shoe No. 1 and No. 2, soft "Diamond S."
- " No. 3 and No. 4, plain soft cast iron.
- " No. 5 and No. 6, hard "Diamond S."
- " No. 7 and No. 8, plain hard cast iron.

It is believed that shoes Nos. 1 to 4, inclusive, are of approximately the same hardness as the "B" shoes of the M. C. B. tests; also, that the "A" shoes of the M. C. B. tests are of a much softer quality of cast iron than is generally used in service under the name of soft cast-iron brakeshoes.

Wheels.—The wheels used in the tests were, one chilled iron wheel, and one steel-tired wheel with spoked center, being same ones used in the M. C. B. tests. The circumference of the chilled



Figs. 1 and 2.

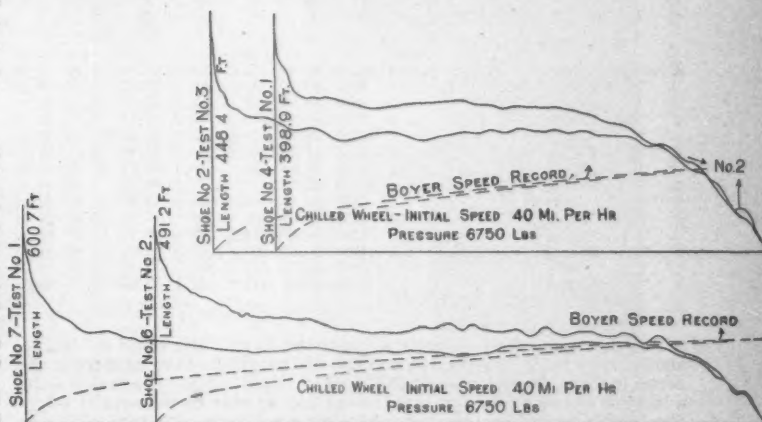
wheel is 103.5 inches while that of the steel-tired wheel is 103.3 inches.

Experiments.—The testing machine has not been used since the last tests made by the M. C. B. Association, and no changes in the apparatus have been made. The same precautions were taken in making the present tests, and the same methods followed, which were used in former work done on this machine.

A comparison of the tests made on steel-tired and chilled wheels shows that the difference between the average mean co-efficients of friction obtained with the same shoe upon the two wheels are slightly higher in the case of the chilled wheel, excepting shoe No. 2 at 40 miles per hour initial speed and 2,798 pounds braking pressure, where the higher average was got on the steel wheel. It would appear, therefore, that practically the same results could be expected, as far as friction is concerned, from steel-tired and chilled wheels, with shoes similar to those tested.

A comparison of the co-efficients of friction given by the soft and hard "Diamond S" brakeshoes (Nos. 2 and 6) shows generally greater friction for the soft shoe, being most apparent at the heavy pressure tests from an initial speed of 65 miles per hour and throughout all of the tests at 40 miles per hour. The results with the two shoes at 2,798 pounds braking pressure and initial speed of 65 miles per hour are practically the same.

Comparing the hard "Diamond S" shoe, No. 6, and the plain hard cast-iron shoe No. 7, in all tests, the shoe with the inserted steel gave higher mean co-efficient of friction. Tests on the steel-tired



Figs. 3 and 4.

wheel with the soft "Diamond S" shoe No. 2 gave higher mean co-efficients than the plain soft cast iron; on the chilled wheel at 2,789 pounds braking pressure and 40 miles per hour initial speed, the results obtained with the two shoes were practically the same, but at the same speed and 6,750 pounds braking pressure the plain soft iron gave higher mean co-efficients.

The steel appears to increase somewhat the frictional qualities of very hard cast-iron brakeshoes, but where soft cast iron is so used the addition of the steel pieces does not greatly affect the friction; the friction in the case of the soft metal being practically the same for both the plain and the "Diamond S" shoes.

Figs. 1 to 4 inclusive are sample diagrams of individual tests which are nearest to the average for their respective groups. The cards from the "Diamond S" and the corresponding plain shoes have been traced so as to have a datum line and starting point in common. The records given by the Boyer speed recorder are also reproduced. The following are the conditions represented by these cards:

- Fig. 1.—Steel-tired wheel; initial speed, 40 miles per hour; braking pressure, 6,750 pounds; shoes No. 2 and No. 4.
- Fig. 2.—Steel-tired wheel; initial speed, 40 miles per hour; braking pressure, 6,750 pounds; shoes No. 6 and No. 7.

Fig. 3.—Chilled wheel; initial speed, 40 miles per hour; braking pressure, 6,750 pounds; shoes No. 2 and No. 4.

Fig. 4.—Chilled wheel; initial speed, 50 miles per hour; braking pressure, 6,750 pounds; shoes No. 6 and No. 7.

TABLE OF RESULTS NO. 1.—TESTS OF 13-INCH BRAKESHOES ON STEEL-TIRED WHEEL.

	Shoe No.	Pressure on shoe, pounds.	Initial speed, miles per hour.	Travel of wheel, feet.	Mean pull on shoe, pounds.	Mean C. of F., per cent.	C. of F. near beginning, per cent.	C. of F. 15 feet from end, per cent.
Average, 3 tests	No. 2	10733	65.19	1330.2	1250.2	11.65	13.15	20.04
" 3 tests	"	6760	63.37	1086.1	920.6	13.63	16.50	23.07
" 3 tests	"	6750	40.46	437.8	1366.6	20.75	23.08	27.61
" 3 tests	"	2798	65.22	3226.0	449.9	16.48	19.34	31.19
" 3 tests	"	2798	40.46	758.3	711.1	25.41	26.06	34.10
" 3 tests	"	6750	40.46	504.4	1218.9	18.06	17.22	26.99
" 4 tests	"	2798	40.80	913.9	655.7	23.43	21.78	35.62
" 3 tests	"	10733	65.04	1863.1	874.3	7.49	8.11	15.51
" 3 tests	"	6750	65.19	1728.5	866.3	12.83	12.96	22.77
" 3 tests	"	6750	40.91	567.4	892.7	13.23	12.96	22.06
" 3 tests	"	2768	63.19	2754.6	468.9	16.76	16.25	30.25
" 3 tests	"	2798	40.46	965.6	491.5	17.31	15.01	29.26
" 4 tests	"	6750	40.46	665.8	827.1	12.14	11.56	22.55
" 3 tests	"	2798	40.61	1176.8	440.9	5.16	13.89	30.38

Summary.—The principal results of these tests can be summarized into the following general statements:

The mean co-efficients of friction obtained from hard and soft "Diamond S" brakeshoes appear to be in the majority of tests slightly greater for chilled than for steel-tired wheels, but the differences are so small that the friction of these shoes can be regarded as practically the same for both kinds of wheels.

In general, the soft "Diamond S" brakeshoes tested give higher mean co-efficients of friction than "Diamond S" shoes of hard cast iron.

TABLE OF RESULTS NO. 2.—TEST OF 13-INCH BRAKESHOES ON CHILLED WHEEL.

	Shoe No.	Pressure on shoe, pounds.	Initial speed, miles per hour.	Travel of wheel, feet.	Mean pull on shoe, pounds.	Mean C. of F., per cent.	C. of F. near beginning, per cent.	C. of F. 15 feet from end, per cent.
Average, 3 tests	No. 2	10733	65.04	1294.1	1336.3	12.44	11.99	22.63
" 3 tests	"	6750	65.19	1613.3	1086.3	16.09	17.33	28.68
" 3 tests	"	6750	40.76	441.0	1478.6	20.87	23.08	30.17
" 3 tests	"	2798	65.61	2064.8	504.6	18.03	23.07	36.95
" 3 tests	"	2768	40.76	871.3	873.7	24.08	27.28	33.24
" 3 tests	"	6750	41.06	409.9	1560.7	23.12	25.34	31.77
" 3 tests	"	2798	41.06	880.1	700.4	25.04	21.70	39.69
" 3 tests	"	11733	65.19	1527.5	1067.9	9.95	9.30	19.82
" 4 tests	"	6750	65.19	1749.7	930.2	13.67	12.88	25.41
" 3 tests	"	6750	40.61	490.4	1196.7	17.73	17.53	28.74
" 3 tests	"	2798	65.49	2914.3	481.6	17.51	18.97	34.72
" 3 tests	"	2798	40.61	898.1	606.9	21.69	21.83	34.87
" 3 tests	"	6750	40.76	641.3	930.5	13.78	13.16	26.79
" 6 tests	"	2798	40.76	1211.4	462.3	16.52	15.07	30.02

The mean co-efficients of friction of the hard "Diamond S" brakeshoes tried were higher than those of the plain shoes cast from the same metal. In the case of the soft "Diamond S" brakeshoes the addition of the expended metal does not appear to materially affect the friction, the results not showing a uniform tendency either to raise or to lower the mean co-efficient.

The friction of the soft "Diamond S" brakeshoe tried is about the same as that of the "B," "C," and "H." shoes of the M. C. B. Tests.

### A Large Interlocking Plant.

The mammoth interlocking switch and signal plant at Hammond, Ind., was tested Nov. 14, and was found to work satisfactorily. The system is composed of 185 levers. The plant was made necessary by the recent crossing of the Western Indiana, Nickel Plate and Michigan Central tracks by those of the Chicago, Hammond & Western. The last named company is responsible for the construction of the system, but in consideration for being permitted to cross the Trunk lines the Western Indiana will operate the machine, and under the new arrangement it will have control of the switches, signals, and crossings of the following roads: Erie, Grand Trunk, Monon, Nickel Plate, Michigan Central, Wabash, State Line & Indiana City, Chicago Terminal Transfer, and the Chicago, Hammond & Western. Forty-eight thousand feet of pipe was

required in the construction of the system, and 91,000 feet of wire was used to connect the levers and signals. One hundred and forty-five trains, or an average of 3,000 cars, pass over the State line every 24 hours, but it is expected to double this when the Chicago, Hammond & Western is completed, as the belt line will be the great artery connecting the Western roads with South Chicago and Hammond.

### The Atlantic City Flyer.

There is a tendency on the part of some foreigners to discredit the remarkably fine records which the Atlantic City Flyer of the Philadelphia & Reading Railway has been making during the past summer. We are sorry for them; they do not know our methods of running trains and cannot understand how such things can be done, especially when they are prone to believe our railroads to be inferior in all respects to theirs, and, withal, rather dangerous to ride upon.

The publication of a note in one of our recent issues commenting upon this remarkable record called forth a protest from one of the most prominent engineers of England, who clearly does not believe the figures to be correct, and seeing the performance reported in the *American Engineer*, he immediately sent us a communication, which we are not at liberty to publish, asking for

Other doubters have expressed themselves through the correspondence columns of our contemporary, *The Engineer* of London, offering such ridiculous explanations for the records as that our mile is only 5,000 feet long. The Atlantic City Flyer does not require defense at our hands, but in order to enable the skeptics, who are doubtless, honest in their convictions, to fully understand how the records were taken, and how the train is regarded here, and to show them just what we claim for it, we print the following letter from Mr. Theodore Voorhees, Vice-President of the road, which needs no further introduction:

Sir: I note the cuttings you inclose from *The Engineer* of London.

It is quite evident that their correspondents are not familiar with the ordinary practice of reporting trains on railways in this country. This train No. 25 was put on for regular business during the summer, and the trips made by it were not intended as in any wise test trips. The train was run under the ordinary conditions pertaining to the service of the road. It is customary for our telegraph operators to report the passing of all trains to the Superintendent's office to the nearest minute in each case. On account of the exceptional speed of No. 25, an endeavor was made to report the train as accurately as possible, and, therefore, reports were given to the nearest quarter minute. These reports were according to the ordinary station clocks, which instruments are regulated by telegraph once each 24 hours, and, of course, are not to be considered as absolutely accurate. No one will pretend for a moment that the reports on July 5 at Meadow Tower and Atlantic City, one minute for one mile and seven-tenths, are correct. An error is manifest in that report. It is possible that errors exist in the reports at other stations and on other dates.

The management of the road has never claimed that the intermediate speeds, as indicated by the train sheet, were absolutely correct. The departures of the train from Camden and the arrivals of the train at Atlantic City were recorded with great care and can be relied upon as accurate. These show an average rate of speed for the entire two months of sixty-nine (69) miles per hour from start to stop. That is correct beyond question.

The suggestion that our miles are short miles is too puerile to notice. Any educated engineer in England knows that the standards of distance are the same in this country as in Great Britain.

I hand you an official record of the train, showing the times as reported on the train sheet for both months, July and August, and also giving particulars in regard to the locomotive and the cars, together with a report as to the number of cars carried each day, the number of passengers and the average time.

THEODORE VOORHEES, Vice-President.

THE ATLANTIC CITY RAILROAD COMPANY,  
OFFICE, READING TERMINAL,  
PHILADELPHIA, Nov. 11, 1897.

Engine 1027, which made the run every day, was built at the Baldwin Locomotive Works, Philadelphia, and its general dimensions are as follows:

JULY.

AUGUST.

Gage.....	4 feet 8½ inches
Cylinders, high pressure.....	13 by 26 "
" " low .....	22 by 26 "
Height of drivers.....	84½ "
Total wheel base.....	28 feet 7 "
Driving wheel base.....	7 " 3 "
Length of tubes.....	13 feet "
Diameter of boiler.....	58¼ inches
" " tubes.....	1¾ "
Number of tubes.....	378 "
Length of firebox.....	113¾ inches
Width .....	96 "
Heating surface of firebox.....	136 4 square feet
" " tubes.....	1,614 9 "
Total heating surface.....	1,835 1 "
Tank capacity.....	4,000 gallons
Boiler pressure, 700 pounds per square inch	
Total weight engine and tender.....	227,000 lbs.
Weight on drivers (about).....	78,600 pounds
" of combination car.....	57,300 "
" each coach.....	50,200 "
" Pullman car.....	85,500 "

## Philadelphia & Reading Train between Philadelphia and Atlantic City.

## Progress in Street Car Construction.

That the progress in the construction of railway cars has not been confined to those used on steam roads is very clearly shown by the illustrations presented herewith. These photographs were received through the courtesy of Mr. H. H. Vreeland, President of the Metropolitan Street Railway of New York, and they show the great difference between the cars of 40 years ago and of the present time. One of the engravings shows an old car which formerly ran on the Eighth Avenue line and was built like a



Forty Years Ago.

stage coach. It is a coach body set on a four-wheel truck. The body is about eight feet long and about five feet wide and will accommodate six passengers inside and six more on the roof.

The new cars are the antithesis of the old ones and represent the latest work of the well-known builders Messrs. J. G. Brill Company, of Philadelphia. These are 28 feet long and 7 feet 6 inches wide. There is nothing very striking about the inside finish, which is the Broadway standard pattern of solid white ash with veneer ceilings decorated, and with chipped beveled edge glass and ventilators. The seats are of wood and the backs are covered with Wilton carpet of a handsome pattern. They are provided with Brill's improved and patented angle iron bumpers, ratchet brake handles, pedal alarm gongs, and radiating draw bars. There will be 50 of these cars, which include an order for 30 now building.

The trucks are the Eureka maximum traction type, as shown in the large engraving, which was designed specially for use where loads are heavy and stops are frequent.

The truck consists of a solid frame carrying two axles and four wheels. The wheels are of unequal diameter, two of large size being used as driving wheels, while the idle or pony wheels are small. The leading and striking feature of the truck is the eccentric disposition of the load, which is so placed as to bring 80 per cent. upon the driving wheels, leaving on the pony wheels only so much as is necessary to guide the truck. There is no transom nor center plate. The side bearings take the whole load, while king or draw pins working in radial plates transmit the power to the body and guide the truck. Brakes are applied to all the wheels. A very short wheelbase is obtained, and by bringing the end piece of the frame inside the pony wheels the whole length of the truck is reduced to the least possible amount. This enables

the low end of the truck to clear the steps when swinging on curves.

Placing 80 per cent. of the weight on the driving wheels leaves 20 per cent. for guidance of the truck. With two motors to a car this gives as great a tractive force as is needed under any ordinary conditions. In practice it is found to be nearly as great in its effectiveness as that of a four-wheel car. This is due to the steadiness imparted by two trucks, and the fact that the pony wheels in snow, etc., clear the way for the drivers. The load being placed in an eccentric manner upon the wheels, according to the builders, is found to give at least 25 per cent. greater tractive effort than can be obtained from other four-wheel center-pivot trucks with a single motor.

## Sanitation of Passenger Cars.

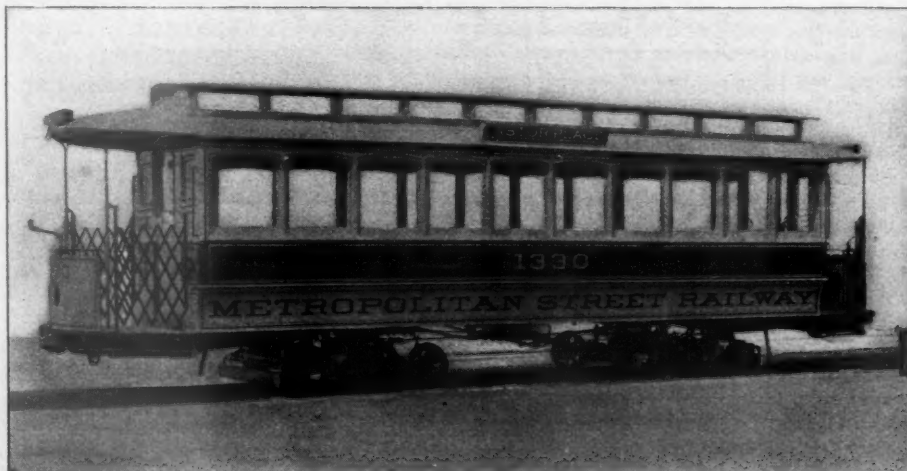
The subject of fumigation and disinfecting, as applied to passenger cars, has been discussed before two of the railroad clubs, and its great importance is apparently becoming better appreciated. Mr. Wm. Garstang, Superintendent of Motive Power of the C. C. & St. L. Ry., is one of the foremost in promoting the sanitation of the cars under his direction, and below we quote from a paper on the subject presented by Mr. J. A. Goben before the St. Louis Railway Club, which describes the practice on that road.

The only reason one can assign for cars not properly cleaned is the cost, hence it is the rule to keep that cost down to the lowest possible limit. The result is that the person in charge has more work to do than can be consistently and well done, consequently much of it is left undone.

Every other part of the maintenance of equipment seemingly has a guardian angel presiding over its destinies, and, cleaning being neglected, is uncharitable enough to uncover a multitude of sins. The average official who is growing gray through worry over his fuel, oil and waste accounts, and who is seeking improvement in that line, never stops to think there is money to be saved to his company in practical, consistent and common-sense cleaning.

He never thinks of the damage that ensues from a senseless, heroic style of cleaning, unless an aggravated case comes under his observation, then a reprimand is supposed to prevent a recurrence. Better remove the cause than try to prevent a repetition. The president, manager or superintendent who fails to investigate the method of cleaning at terminals, or who, when riding over the system in his special car, does not go forward to the smoker, or other day coaches, cannot be aware of their condition.

Those of you who have watched the cleaning of coaches at terminals know full well that the average cleaning is very detrimental to such elastic and sensitive articles as varnish and paint, and you know the average cleaner cares little about what he uses so that it cleans and cleans quickly. He only knows that strong soap is the thing to do it quickly, and he learns that concentrated lye, sal soda and ammonia are quicker, consequently they are the ever-ready



A New Brill Electric Car.

agents resorted to when in a hurry, which is generally the case at all times. I have on more than one occasion witnessed the baneful results of such pernicious practice. I have a vivid recollection of a road, with which I was connected several years ago, placing in service four new vestibuled trains in the month of May. The road, at that time, did not own or control the terminal where these cars were cleaned. They were very exacting, however, in the matter of cleaning, and the terminal company met their demands in a heroic manner. In October of that same year these cars had to be sent to the shops for repainting, and from no other cause than a senseless method of cleaning. Perhaps you will say this was a costly and bitter experience. On the contrary, it was a blessing in disguise, for it brought these people face

to face with a condition which they did not realize ever could or would exist. A reform was immediately instituted that dispensed with strong soap and water, pumice stone, acid and alkali. A practical method was adopted from which no deviation was made, except to improve it, where possible, and they are well satisfied with the results obtained, as it has materially lessened the cost of painting and has assured them handsome, cleanly and healthful equipment that meets the approbation of their patrons. In addition to this, it has engendered a spirit of pride in all its employees that assists materially in maintaining an equipment that is hard to excel, and the encomiums they receive is an ample return for the money expended. It is a first-class advertisement.

We find it better to have the cleaning force an exclusive one. Let it be understood that they are to do cleaning and nothing else, and they will soon become practical and efficient. On the contrary, if you expect your cleaners to do other work, such as oiling, inspecting and laboring, and to do cleaning when not engaged in the other duty, you will find that your cleaning will be spasmodic, inefficient, worthless.

The cleaning force should be under the immediate control of the general foreman of terminals. If the paint shop is contiguous to the terminal, the foreman painter should determine the method of cleaning, and should give reasonable supervision to same. He is certainly interested in the preservation of his work after leaving shop, and no one is more capable of supervising it. If the paint shop is remote from the terminals, a shop painter should be placed at the head of the cleaning force. It would not require one of the best, however, a medium grade one would answer.

As to the sanitation of passenger cars, I do not feel disposed to suggest to the railways the duties they owe to the public at large

lons of clean water; agitate until a perfect mixture is assured. Spray with sprinkling can the floor, inside of hopper, urinal and walls of saloon. Can containing solution to be kept closed when not using, so as to retain full strength.

6. Clean and wipe windows with tripoli and waste for each 100 miles or more.

7. Wipe off body and trucks of car each trip of 100 miles or more, and for every 2,000 miles made, clean body of car with modoc liquid cleaner.

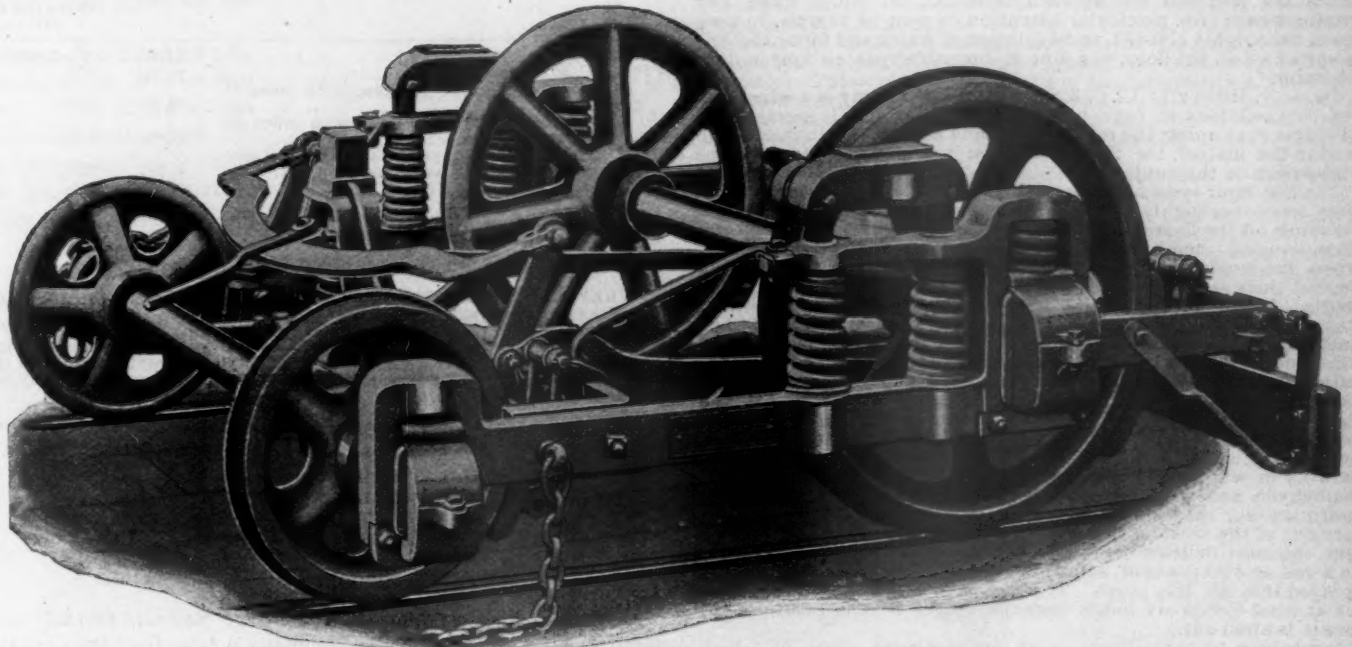
8. Parlor, buffet and dining cars to be treated the same as coaches, except cleaning the carpet, which must be taken up and dusted and cleaned every second trip. Food boxes and refrigerators in buffet in dining cars to be cleaned and treated with formaldehyde once a week during the summer months.

9. Combination parlor and sleeping cars, when in use, to be treated the same as coaches and straight parlor cars, except bedding, which must be removed, thoroughly cleaned and aired each trip.

10. Private and pay cars to be thoroughly ventilated each day while in yards by opening windows—keeping doors locked—and should not be cleaned until notice is given that they will be required for service. Food boxes and refrigerators in these cars to be treated the same as those in buffet and dining cars.

11. All extra or unassigned passenger equipment stored at terminals must be kept well ventilated and presentable at all times.

12. Sample of drinking water used in passenger equipment cars must be sent from each terminal to the Superintendent of Motive Power, to be analyzed, every six months, and oftener if the foreman in charge has any doubt as to its purity. Foremen must report to the Master Mechanic any and all cars requiring shop attention.



The Eureka Maximum Traction Truck.—The J. G. Brill Company.

in the preservation of health. It would be presumption on my part to do so. However, the day is not far distant when the sanitary condition of passenger cars will be greatly improved as the State boards of health of the different States are looking into this matter, and you had better get your equipment ready for inspection.

I take pleasure in appending a copy of the rules and regulations governing the cleaning and sanitation of passenger cars at the terminals, which has lately been issued by our company, leaving out the special instructions to terminals. By these you will see that we are attempting at least to provide for the sanitation of our coaches, and will say that same have been submitted to the Secretary of the State Board of Health of Indiana, who has approved them.

#### CAR CLEANING RULES.—C., C., C. & ST. L. RAILWAY.

1. All passenger coaches must have doors and windows opened immediately on arrival at cleaning yards, the same to remain open until departure or nightfall, except in stormy weather.
2. Seats and backs thoroughly dusted and cleaned by air where practicable; seat arm rests, where finished in wood, to be washed off with solution of formaldehyde each trip of 100 miles or more.
3. Dust out or wipe off inside of car each trip of 100 miles or more. Scour inside of water coolers once a week with hot water. Every 30 days clean the interior of car with a weak solution of modoc powdered soap, mixing as follows: One pound of powdered soap to six pounds of water.
4. Oil lamps to be filled, trimmed and cleaned each trip of 100 miles or more. Pintch gas lamps cleaned and tips examined each trip of 100 miles or more.
5. All saloons must be scrubbed, urinals thoroughly cleaned and both disinfected each round trip of 100 miles or more with formaldehyde, as follows: One pint of the solution placed in five gal-

In the discussion of Mr. Gohen's paper the author stated that the expense for thorough cleaning did not exceed from 15 to 17 cents per 100 miles run, and on the Chesapeake & Ohio, which road, owing to the work of Mr. W. S. Morris, Superintendent of Motive Power, has the reputation of having the cleanest cars to be found, the cost is 23 cents per 100 miles.

The subject of car sanitation embraces the cleaning by disinfecting solutions, as already described, and also fumigating, and the following paragraphs are taken from the proceedings of the Western Railway Club of October, 1897, as showing the methods used for accomplishing this:

Mr. F. W. BRAZIER (Illinois Central): Having been asked to give the method of disinfecting passenger equipment on our system, I will briefly, yet clearly as possible, explain it.

Our passenger equipment is disinfected by the gas of formaldehyde, which is produced by the following formula: 8 ounces calcium chloride, 1 pint water, 2½ pints formaldehyde. Dissolve the chloride in water, filter and mix with formaldehyde. The above quantity is required to fill an empty generator to its capacity: 1½ pints must be in the generator at all times, when the generator is in use, to insure safety. A regular charge, the quantity of which can be entirely used without refilling, amounts to 2½ pints of the solution. Formaldehyde gas is made by boiling the above mixture in a C Formal generator No. 1 with a Primus No. 1 apparatus. To obtain the necessary amount of vapor to fumigate a car, the liquid is boiled until it reaches a pressure of 45 pounds; it is then applied to the car. The time required to obtain 45 pounds pressure is about 20 minutes. When our trains arrive at the terminals we take them immediately to our cleaning yards, close all windows and doors, open the toilet-room doors, and, in sleeping cars, open all the

berths, and doors to closets and inside rooms. We then inject the formaldehyde gas by inserting the tube through the keyhole of the outside door. The time used in application is as follows:

Class of car.	Time of application.	Cost Material.	Cost Labor.	Total Cost.
Baggage.....	15 minutes.	18¢.	8c.	26¢.
Mail.....	20 "	24¢.	9c.	33¢.
Coach.....	20 "	24¢.	9c.	33¢.
Sleeping.....	30 "	37c.	11c.	48c.

The cars are kept locked  $4\frac{1}{2}$  to 5 hours, then they are opened and thoroughly ventilated. The odor of the formaldehyde quickly disappears. We then clean the cars, scrub the floors, clean out all water tanks and toilet rooms. When the cars go into service fresh water is supplied to all tanks for drinking water.

In answer to the question if formaldehyde gas affects paint, varnish or textile fabrics, I will quote from part of the Public Health Reports to the United States Treasury Department under date of Jan. 29, 1897: "While this gas stands as the best known germicidal agent, it also commends itself for the purpose, in that it has no detrimental effect upon the finest textile fabrics, upon colors, the finish of household furniture, pictures or tinseils. It will not attack gold, silver, copper, brass or zinc, but does excite oxidation in steel and iron. It does not injure paint or varnish, hence it is especially valuable, inasmuch as contaminated rooms may be disinfected without special preparation or removal of articles." It will thus be observed that this gas will not injure the inside finish of the cars. Under the advice of the State Board of Health we have continued this system on our road.

It would not be out of place to state that we give our passenger equipment a thorough cleaning after it is disinfected. Seats and seat backs are dusted and cleaned by air, when practicable. The floors are scrubbed out at each terminal, oil lamps filled and trimmed each trip, particular attention is paid to urinals, to keep them thoroughly cleaned, and a solution of water and formaldehyde is sprinkled on the floor, one pint of formaldehyde to four gallons of water.

Dr. J. N. HURTY, C. C., C. & St. L. Ry.: It certainly is a wise thing for the railroads to take hold of car sanitation. It seems to me probable that unless the railroads do take hold of it voluntarily and lead in the matter, the first thing you know they will have some legislation on the subject.

The Big Four system has been disinfecting in this way: First, they clean thoroughly in the ordinary manner by sweeping out and washing off the floors, scrubbing, and then applying an antiseptic floor dressing, then by washing off the arm rests when these are of wood, the window ledges, etc., where children might crawl and deposit their saliva, which is a great method of propagating diphtheria. If a diphtheritic child, with the diphtheritic germs still in its throat, deposits some of its saliva upon an arm-rest and then another child comes along and gets it in its throat, on goes the diphtheria. That is one of the main methods by which it is propagated. So after sweeping and mopping and applying the antiseptic oil as often as is necessary, and washing the arm-rests and then washing the window ledges, they go over them a second time with a two per cent. solution of formaldehyde which is distributing it in close spots; then they have invented a spraying apparatus in which they take a one or two per cent. solution of formaldehyde and with the compressed air in the cylinders underneath the car they spray every seat thoroughly. It does not injure any of the finish of the car or any of the metal or the plush; in fact, the most delicate colors are not injured by the formaldehyde. So a one or two per cent. solution of formaldehyde is thoroughly sprayed into all the plush. The car is allowed to remain closed for at least five or six hours, perhaps longer if it is possible, before it is aired out.

In addition to that, there is an arrangement made by which every month they will fumigate thoroughly to the extent of the United States requirements. Perhaps it would be better to do that at the end of every trip; however, the expense would be very great and it is possibly uncalled for because of the other disinfection.

The speaker described the wood alcohol apparatus and stated that if the chimney was removed the lamp burned with the usual alcohol flame and the production of carbonic acid gas and water, but when the divided chimney was put on the products of combustion were thrown back upon the flame and converted into formaldehyde gas. He stated the cost of fumigating to be 33 cents per car per application and said that the gas was not injurious to human beings, though it could be depended upon to kill bacilli.

To illustrate the method whereby disease may be propagated upon trains, he said:

There was in Indianapolis a child recovering from diphtheria; the diphtheritic infection was yet in its throat, and by order of the health department a quarantine had been laid and the parents had been told that the child must not go to school as long as the infection was not gone from the throat. If the child had gone to school, it would readily have left some saliva upon the edge of the cup, or with its fingers upon the slate, would transfer it from the slate to the top of the desk and in that way make it very risky for the other children, therefore it was ordered that the child should not go to school, and the parents were watched pretty closely by the sanitary officers. But what did they do but bundle up and go down to Louisville. Now it happened to be the day before the opening of school (that was a year ago this fall), and teachers who had been to teachers' institutes were returning to their schools. Very shortly after these teachers had opened their schools, in four separate places along that line, diphtheria broke out in the schools. That is coming pretty close to proving one thing, namely, that the teach-

ers had drunk from the same cup as the child, or that the child, as children do, had been squirming around, getting its fingers into its mouth and getting its saliva on the arms of chairs, or the ledges of windows, and they had thus become infected. That is the most remarkable instance of spreading diphtheria, and it does look very much as if these four school teachers had become infected on that train, for it was within the specified time, about six or ten days, that diphtheria broke out in their schools. These teachers did not have diphtheria, but they did have diphtheritic organisms in their throats when they were examined. We now know on what precipices we live with regard to these infectious diseases, and surely now, since we have found out how these diseases are spread, we should aim to prevent them.

#### Centers of Gravity of Freight Cars and Trucks.

The height of the center of gravity of several types of cars above the tops of the rails upon which they stand is given by Mr. R. A. Parke, in a paper read before the New York Railroad Club, as they were taken by Mr. A. S. Vogt, Mechanical Engineer of the Pennsylvania Railroad. The car bodies and trucks were suspended for the purpose of making these determinations, which are given as follows:

Class of Car.	Weight.	Height of center of gravity above top of rail.
P. R. R. box.....	32,000	65 inches.
*P. C. C. & St. L. stock.....	26,000	67½ "
P. R. R. hopper bottom gondola, with sides 47 inches high.....	26,100	46½ "
P. R. R. drop bottom gondola, with sides 30 inches high.....	25,900	43½ "
P. R. R. hopper bottom gondola, with steel bolsters and longitudinal truss rods.....	26,700	45½ "
*P. W. & B. flat.....	21,200	42½ "
*P. R. R. 4-wheel caboose.....	37½ "	21 "
1/2 P. R. R. 4-wheel passenger truck.....	5,500	19½ "
P. R. R. 4-wheel freight truck.....		

\*Without air-brakes. The application of air-brakes would slightly lower the center of gravity.

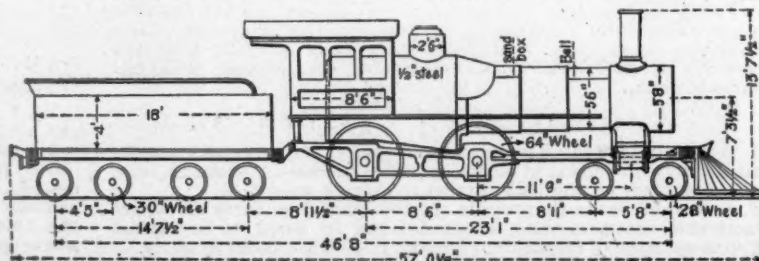
†As there was no load upon the springs, the truck frame was higher, with respect to the equalizers, boxes, wheels and axles than is the case in service. This would give a slightly higher center of gravity than that in service. In service, the center of gravity of the truck would probably be about 20½ inches.

The heights of the centers of gravity are all measured from the top of the rail. The cars were all *without* trucks, except the caboose, but the weights given include the trucks.

#### New Eight-Wheel Suburban Locomotives—New York Central.

The New York Central & Hudson River Railroad recently ordered 10 eight-wheel suburban locomotives from the Schenectady Locomotive Works, of which we show a diagram and give the chief dimensions. The fuel will be hard coal, which is made necessary by their being used for suburban work:

Weight, engine, working order.....	110,000 pounds
" " on drivers.....	77,000 pounds
" " on truck.....	33,000 pounds
" tender, loaded.....	78,000 pounds
Driving wheels, diameter.....	64 inches
Cylinders.....	18½ inches by 22 inches
Steam port.....	1¼ by 16½ inches
Exhaust port.....	2¼ by 16½ inches



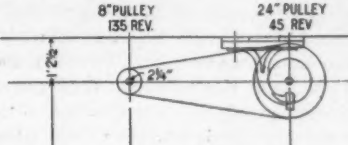
New York Central Suburban Engine.

Bridges.....	1½ inches
Valves, travel.....	5½ inches
" outside lap.....	¾ inches
" inside lap.....	¾ inches
Exhaust nozzle, double diameter.....	3¼ inches
Boiler diameter, smallest ring.....	56 inches
pressure.....	160 pounds
Firebox, length inside lap.....	114½ inches
" width.....	40½ inches

Flues, number .....	254
" outside diameter .....	3 inches
" length .....	11 feet 7 inches
Total heating .....	1,743 square feet
Graze area .....	32.6 square feet
Driving journals .....	8½ inches by 10½ inches
Coal capacity, tender .....	6 tons
Water " " .....	3,500 gallons

**Air Hose Testing Machine—C., M. & St. P. Ry.**

Among the interesting machines recently devised for testing air-brake hose is that which is in use at the shops of the Chicago, Milwaukee & St. Paul Railway, and was designed to vibrate the hose while under pressure. The drawings are sufficiently clear to be understood at a glance. A re-



8" PULLEY  
135 REV.

24" PULLEY  
45 REV.

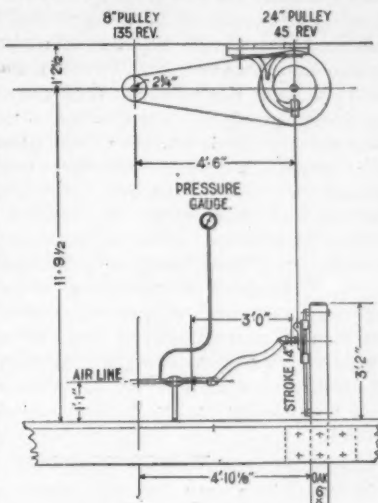
2 1/2"

11' 9 1/2"

4' 6"

PRESSURE GAUGE.

The rack is fitted for testing six pieces of hose at a time. The stroke of the machine was made 14 inches because this is about the maximum amount of vibration that may be given to a 22-inch hose, and being the vibration used in the earlier machine it was also used in the present one. The testing machine is located in the physical testing room at West Milwaukee, and all the tests are made under the direction of the attendant in charge



### Air Hose Testing Machine.

It would be very interesting to have the records of some of the tests to reproduce here, but this information is not available. One of the interesting features that have been brought out in the tests is the great differences in the temperatures attained by the different makes of hose during the tests. The different styles of hose and the different methods of making it are said to have a marked effect in this particular. Some makes are shown to be flexible and these do not increase much in temperature, while others of a hard and stiff character become very hot.

There are many questions of great value to be settled by such a machine and the great importance of obtaining the very best air-brake hose warrants the trouble of going into it in this way. The main object of the tests is to reproduce the conditions of service as nearly as possible in the tests and to wear the hose to destruction within a time that will permit of taking records. We are indebted to the courtesy of Mr. A. E. Manchester, Assistant Superintendent of Motive Power of the road, for the drawings and information concerning this machine.

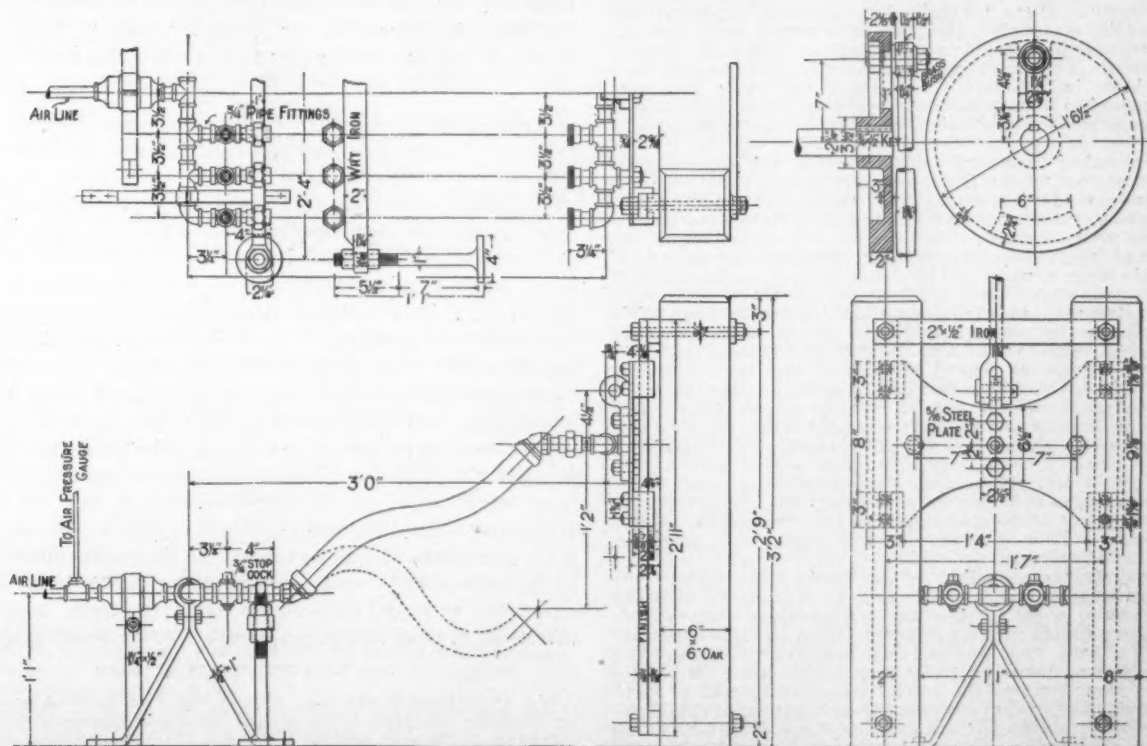
## A "Perfect" Truck for Passenger Cars.

In our August issue, 1896, page 193, we presented an illustrated description of the "Perfect" passenger car truck as manufactured by Messrs. J. G. Brill & Company, of Philadelphia, and readers are referred to that description for illustrations showing the design and method of construction used.

A pamphlet has just been received from these builders containing information pertaining to this type of truck. Besides describing some of the important mechanical features, the circular gives a series of letters received from railway men who have these trucks in operation. These letters are worthy of special attention, because they give the experience of practical railway men who have been using this truck. In some cases they have been employed on lines nearly 50 miles long where a speed of 40 miles an hour is maintained.

One remarkable feature should not be overlooked. Although there are 500 of these trucks now in service, yet the almost universal expression of the letters is that they have never been off the track. Up to the present writing, Nov. 5, 1897, no case of derailment has been reported. This is the more remarkable because the trucks have been fitted with narrow tread wheels, having shallow flanges suitable for street car rails.

Steam railroad men will be interested in the fact that on the Oakland, Alameda & Piedmont Railway (now the California Railway), of Oakland, Cal., these trucks are used under standard 50-foot steam railroad car bodies, which weigh 50,000 pounds. This is



**Air Hose Testing Machine.—C., M. & St. P. Ry.**

of the room, who takes a careful record of the tests, noting any defects that may appear in the hose which is kept on the rack where it vibrates at the rate of 45 strokes per minute until it bursts and allows the air to escape.

practically steam service and the trucks are giving the best satisfaction.

Those who visited Niagara Falls at the recent convention had ample opportunity to test the ease with which these trucks pass sharp reverse curves (70-foot radius) at 30 miles per hour.

### The Future of American Railroads.

In an address by Mr. M. E. Ingalls, President of the "Big Four" system, before the students of Purdue University, November 22, the subject of American railroad problems was presented with such clear thought and admirable expression that we would like to give our readers the opportunity to see it in full. After considering the conditions existing at the time of the first railroad construction and the causes leading to them, the speaker gave a detailed account of the vast proportions to which railroad industry had reached and went carefully into the causes which had led to the adverse legislation that is now a menace not only to further development but to the conduct of railroad business in the interests of the masses of the people. The following paragraphs are taken from the conclusions of the speaker:

What is the future? There must be changes in legislation and in the management of railways. Some plan must be adopted to increase the ownership in railways by parties residing along their lines. The first great step toward doing this must be a reform in the tax laws, so that citizens of Indiana or other States can be put upon as favorable terms for ownership of bonds and stocks in a railway as citizens of New York. Greater permanence must be given to the condition and ownership of railways. It would be a great step if we could adopt the English method and create debentures instead of bonds, or in other words, provide that there should be no foreclosure for non-payment of interest. Such a thing as foreclosure of a railway in England is unknown. If the interest is not paid upon the debentures there may be a receiver of the profits, but the stockholder still holds his interest in the property. Here with our system of bonds, if there comes a few bad years when the interest is defaulted, the bondholder takes possession and sells it under his mortgage, the interest of the stockholder is extinguished, and when prosperity returns he has lost his opportunity to get his share of it. This makes the possession of railway stocks speculative and uncertain; in fact, for years they have been more subject to assessments than to the receipt of dividends. If our form of mortgage could be changed to that of the English debenture, it would stop the immense number of reorganizations and would prevent values being wiped out in times of panic and would encourage investment by the people in the securities of these enterprises; for after all, that is the real improvement that is to come. The New England railways have less trouble with legislatures and courts, chiefly because they have a great many small holders of stocks along their lines and in the cities, each of whom is an agent of the corporation and aids in creating public sentiment and procuring fair treatment; while in the great central States and in the West there are scarcely stockholders enough to provide the officers for a stockholders' meeting. The railway officials themselves must be taught to conduct their business with care and with due respect to the rights of the people. Their actions must not be secret, but above board and open to the public. There must be but one rate to everybody, and that must be reasonable, and the legislatures must provide remedies by which railway officials can agree with each other on these rates and their contracts can be enforced. The present State and national laws in reference to railways are crude and crazy patchworks passed in some cases out of revenge for wrongs, real or fancied, and in others for political effect, and all in opposition to the railways.

The improvement of the country demands that the great articles of export, like cotton, wheat, flour, corn and meats, should be carried at the lowest possible rates. The railways should pattern after the English system, and, while making extraordinarily low rates for these great articles, should exact a terminal upon the higher classes of freight and upon freight carried short distances, so as to provide interest upon the immense terminals they have to have.

Passenger rates are made entirely upon the wrong basis. We charge the same for the man who rides in the palace car, and for whom the railway has to haul two tons of dead weight, as we do for the man who rides in the ordinary coach, and for whom only one-half a ton of dead weight is hauled. We charge practically the same for the passenger who is carried 60 miles an hour on the fast and expensive train as we do for the passenger upon the slow and less expensive train. These rates should be changed and graded.

Above all, a better understanding must be arrived at with the vast army of employees. They must have greater interest in the success of the railways and they must be a part of the power that will produce a better understanding with the communities which the railways serve. This must be done by a system of hospitals, pensions and profit-sharing.

Probably locomotives propelled by electricity will come in the future. If not, something else may. And we cannot tell what the next years have in store in the way of improving our railway facilities. Higher speed, possibly cheaper trains, but it is necessary to this country of ours that the railways should be encouraged so that they may go on improving their systems, so that branch lines can be built to every county seat in the country. Instead of stopping at 182,000 miles of railway we should at least build five thousand miles a year in short and inexpensive lines as feeders to the main systems, so that the days of the stage coach and the heavy wagons should be unknown. This country will soon have one hundred millions of people. It will require at least 250,000 miles of railways to serve them properly—an increase of 40 per cent. over the present mileage. They cannot be built, they cannot be improved and increased, with the present system of legislation and with the present prejudices against them. The development of the country demands that this must be changed. It is through such institutions as this, it is through such students as these, that the change must come. In the

centuries that have gone, the youth of the various countries sought fame and preferment in war and its accompaniments. We live in better days and in a higher civilization, but the service of our railways offers a wider field for advancement and for fame than anything of old. The road to success in this line is not through carnage and suffering, but it is none the less sure, and requires equally moral courage and intelligence. A new evangel must be preached in reference to railways; they must be placed upon a higher order, and instead of being pariahs in business they must be the benefactors and friends of all.

### The Walker Company.

The entire stock and property of the Walker Company, Cleveland, O., has just been acquired by four prominent New York business men, Messrs. Roswell P. Flower, Perry Belmont, J. W. Hinkley and Anthony N. Brady. The capitalization of the company is \$2,500,000 and the bond issue \$1,500,000. One of the principal owners was Mr. J. B. Perkins, of Cleveland, he having stock to the value of nearly \$2,000,000. His interest, as well as that of the former president, Mr. Billings, is taken entirely. The stock of Mr. Sidney H. Short, the vice-president and electrician, is also taken, although he does not change his active relations to the company. The officers remain the same. The capital represented is almost limitless, and the result of this transaction is to be the development of the Walker Company into the greatest electrical manufacturing concern in the world. Elsewhere in this issue a statement is presented of the high regard in which American electrical apparatus is held abroad, and with the combination of the business ability of these men, the engineering experience of Mr. Short and the excellent plant at Cleveland, covering 12 acres, the Walker Company will doubtless be a very strong factor in electrical development at home and abroad.

It would be a very difficult matter, even if anyone was so disposed, to refute the statements of Mr. Charles E. Wheeler in his paper on the Commerce of the Great Lakes and presuming them to be correct there is a great deal in them for railroad men to think about. Further reference will probably be made to them in our pages, but at present we shall only call the attention of our readers to the paper which is reproduced nearly in full in this issue for the special purpose of presenting the question as to whether it is not possible for locomotive men to reduce the lead which the marine engine now enjoys as an economical machine.

A new illuminant is reported upon by Consul Deuster, of Crefeld. Mr. Ernest Salzenberg, director of the gas works of the city of Crefeld, has invented an improvement in incandescent gas burners, which relates to the production of incandescent gas-light, based upon the discovery that, when the pressure of the gas is considerably increased upon the incandescent body, that body emits a golden-yellow light very agreeable to the eye, displaying objects in their natural colors. The gas is supplied to the burner at a pressure of about 3½ atmospheres, the burner, to withstand this high pressure, being of special construction. A single incandescent jet of the ordinary size can emit a light of much more than 1,000 candle-power. The light is of such intensity that a person is enabled to read fine print at a distance of 100 to 150 ft. The inventor claims that the cost of his incandescent light of 1,500 candle-power is only 4½ cents per hour, while that of the ordinary electric light of 400 candle-power is (in Germany) 14 cents per hour. In the apparatus constructed by Salzenberg a hydraulic pressure of 3.5 atmospheres, and even more, may be forced through the improved Auer burner. The invention is, however, only applicable where water-works exist.

We are informed that the "Grand Prix" or highest possible distinction for machine tools at the Brussels Exposition has been awarded to Messrs. Brown & Sharpe Manufacturing Company, to the Pratt & Whitney Company and to one Brussels firm. Messrs. Gould & Eberhardt received a gold medal, which was next to the highest distinction, and a silver medal was awarded to the Acme Manufacturing Company, of Cleveland, O.

The Russian Locomotive Construction Company has, according to a cable dispatch to the New York Sun, been authorized by the government to place orders for 400 engines abroad.

## The Baltimore &amp; Ohio Annual Report.

The 71st annual report of the Baltimore & Ohio Railroad Company, submitted Nov. 15, at the meeting of the stockholders, shows gross earnings for the year ending June 30, 1897, of \$25,582,122.31, an increase of \$1,637,340.71 over the previous year, and \$2,764,940.07 more than in 1895. The freight earnings were \$18,336,851.87, an increase of \$1,518,190.03, which increase is ascribed to the many improvements and large increase in equipment afforded the patrons of the line by the Receivers and to a general and intelligent effort to increase the traffic of the road. The passenger revenue was \$5,059,001.92, a decrease of \$256,941.47, or \$9,704.65 more than was earned in 1895. The miscellaneous earnings increased \$378,749.15, of which increase the elevators contributed \$326,779.38, they having earned \$514,125.11 in 1897 as against \$187,355.73 in 1896.

The total expenses of the line were \$20,012,093.81, an increase of \$2,428,673.46. This increase is explained by the statement of the large sums required in maintenance of way and maintenance of equipment, which went into the property for the purpose of improving its earning capacity such as putting all of the engines and cars into good condition. Considerable work has been done at Locust Point to improve the facilities for unloading ships. The report of the General Managers shows that the tonnage carried, including coal and coke, was 18,716,665, an increase of 854,728 tons, or 4.8 per cent. The tons carried one mile increased 666,903,303, an increase of 23.4 per cent. During the year nine locomotives were rebuilt, 445 received thorough repairs, 1,339 ordinary repairs were made, 211,012 running repairs made. The total cars in service June 30, 1897, were 672 passenger and 30,980 freight. The locomotives number 868. The car mileage increased 55,540,468. The total number of passengers carried in 1897 was 8,344,073, a decrease of 223,116.

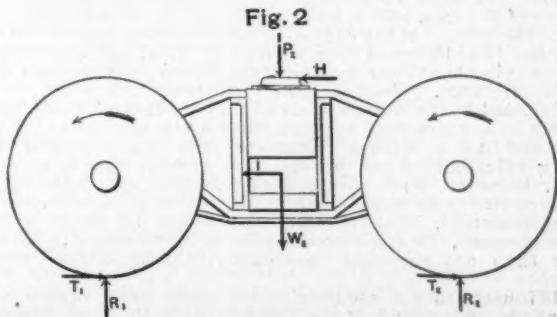
## The Effect of Brakebeam Hanging Upon Brake Efficiency.\*

BY R. A. PARKE.

Surrounded as it is by dynamical conditions which are in themselves very complicated, and which are only partially understood, it is not surprising that a systematic analysis of the design and action of brake gear has been neglected; but the complexities are not too great to permit a sufficiently satisfactory analysis to be made, and the prospective benefits to be derived from the information thereby obtained appear to reward the tiresome work which such an analysis has involved. That such an analysis has afforded the clue to such a simple modification of the present mode of suspending brakebeams as will enable trains to be stopped thereby in from 10 to 15 per cent. shorter distance, sufficiently attests the value of attacking dynamical problems through the methods of theoretical mechanics.

It should be plain that what actually retards the motion of the car is the frictional resistance of the rail upon each wheel, which is initiated whenever any force acts upon the wheels to cause them to lag in their continued rotation. It is to be remembered also that the persistent rotation is only of such degree as is necessary at any time to overcome the resistance to the rotation of the wheel.

The tendency of the frictional resistance applied by the rails to the wheels, when the brakes are applied, is to overturn the car



body about an axis of rotation which is situated at the center plate upon the forward truck, and also to overturn each truck about an axis of rotation situated at the point of contact between the forward pair of wheels and the rails.

All the retarding forces are applied to the car body at a point considerably below its center of gravity. The resultant of this system of retarding forces is an eccentric force resisting the forward motion of the car body. It therefore tends both to cause a retardation of the motion of the car body and to cause the car body to rotate about the forward center plate. The result is that the portion of weight carried upon the rear truck is diminished, and there is a corresponding increase in the weight carried upon the forward truck.

\* From a paper presented at the November meeting of the New York Railroad Club.

Such being the fact, it is unquestionable that a less pressure of the brakeshoes must be exerted upon the wheels of the rear truck than could be exerted upon the corresponding wheels of the forward truck, to prevent wheel sliding at the rear truck. The greatest brakeshoe pressure which can be applied to the wheels, without causing them to slide upon the rails, is thus limited by the pressure of the wheels of the rear truck upon the rails, and no further consideration whatsoever need be given to the forward truck.

Fig. 2 represents the rear truck of the car under consideration. Here it will be seen that the forces  $T_1$  and  $T_2$ , resisting the forward motion of the truck, are applied at the lowermost points of the structure, while the forces urging the truck forward are, first, the force  $I$ , due to inertia, applied at the center of gravity of the truck, and, second, the force  $H$ , applied at the center plate, far above the center of gravity. This condition inevitably results in a reduction of the normal pressure of the rear pair of wheels upon the rails, and in a corresponding increase in the pressure of the forward pair of wheels upon the rails.

We finally reach the primary object of this discussion, which, briefly stated, is a realization of the facts that, during any application of the brakes, the rear truck carries the least weight, and in any case where the brakebeams are suspended from the truck, the rear pair of wheels of the rear truck exerts a less pressure upon the rails than any other pair of wheels upon the car.

If this fact is now clearly understood, it will be equally clear that, in order to prevent wheel sliding, a uniform brakeshoe pressure upon each pair of wheels must be limited to what is safe upon the rear pair of wheels of the rear truck.

In a communication to the *Railroad Gazette* of Oct. 24, 1890, it was pointed out that a variation in the angle at which the brakebeam hanger inclines to the tangent to the wheel at the center of the brakeshoe results in a variation in the pressure of the brakeshoes upon the wheels. The principal purpose of that investigation was to call attention to the fact that inefficiency, on the one hand, and wheel sliding, on the other hand, might thus be accounted for in cases where other reasons appear to be absent. It was also there pointed out that, in order to obtain a uniform pressure of the brakeshoes upon each pair of wheels, the brakebeam hangers must

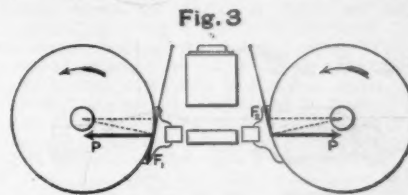


Fig. 3

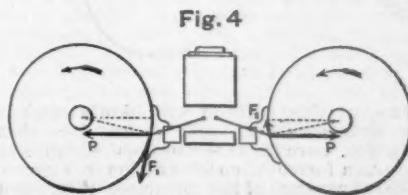


Fig. 4

be practically parallel to the tangent drawn to the wheel at the center of the brakeshoe.

A careful investigation has revealed the fact that, by a proper inclination of the brakebeam hangers, the brakeshoe pressure upon each pair of wheels may be fairly proportioned to the pressure of that pair of wheels upon the rails. The utilization of this principle will now be considered.

It is manifest that the rear pair of wheels, when the car is moving in one direction, becomes the forward pair of wheels when the car is moving in the other direction. It is, therefore, absolutely essential that any successful method employed for increasing the brakeshoe pressure upon a pair of wheels, when the car is moving in one direction, must decrease the brakeshoe pressure upon that pair of wheels when the car is moving in the other direction. This is precisely what results from a proper inclination of the brakebeam hangers.

Fig. 3 represents the action of the brakes upon each pair of wheels of a truck when the brake hangers have the direction of the tangent to the wheel at the center of the brakeshoe. The same pull  $P$  is applied to each brakebeam. The brakeshoes apply a downward frictional force  $F_1$  to the forward pair of wheels and an upward frictional force  $F_2$  to the rear pair of wheels. The center of the brakeshoe is shown to be at the intersection of these forces upon each pair of wheels, and lines representing the brake hangers are drawn tangent to the wheels at those points. It must be observed that, with whatever force  $F_1$  the brakeshoes act downwardly upon the surface of the forward pair of wheels, the wheels react upwardly upon the brakeshoes, and this upward force is directly resisted by the brake hangers. There is thus a direct compression in the forward brake hangers equal to the frictional force  $F_1$ . In a similar manner it will readily be understood that the rear brake hangers are subjected to a tension which is equal to the frictional force  $F_2$ .

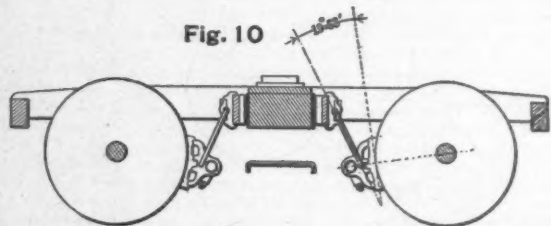
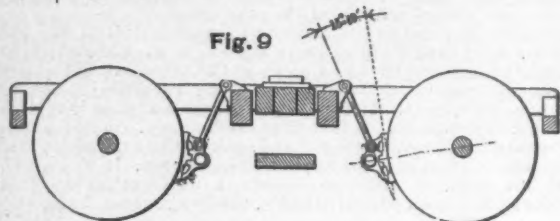
Let us now consider an exaggerated case of inclination of the brake hangers, such as is shown in Fig. 4. Each brakebeam is here subjected to the same pull  $P$  as in Fig. 3; but the fractional forces of the brakeshoes upon the two pairs of wheels are no longer equal, as they were in Fig. 3. When the brakeshoes have been brought into contact with the forward pair of wheels, the combination is something similar to a toggle-joint. The reacting upward friction of the wheels upon the brakeshoes tends to carry the brakeshoes upwardly, along with the surface of the wheels, and on account of the nearly horizontal position of the hangers, there is a strong tendency to force the forward pair of the wheels away from the center of the truck. This tendency is, of course, resisted by the truck frame, and thereby a powerful pressure occurs between the brakeshoes and the wheels, in addition to the pressure resulting from the pull  $P$  upon the brakebeam. In this way, the brakeshoe friction  $F_1$ , upon the forward pair of wheels of Fig. 4 is materially greater than is the case in Fig. 3, where the angle of the hanger is such

that it exerts no influence to force the brakeshoes against the wheels.

The effect of the inclination of the hangers upon the friction of the rear pair of wheels of Fig. 4 is precisely the reverse of what it is in the case of the forward pair of wheels.

It is thus seen that if the brake hangers are so adjusted that they have the same angular direction as the tangent drawn to the wheel at the center of the brakeshoe, as in Fig. 3, the frictional resistance offered by the brakeshoes to the rotation of the wheels will be the same upon each pair of wheels. If, however, the brake hangers be sufficiently inclined to the tangent at the center of the brakeshoe, the frictional resistance of the brakeshoes to the rotation of the forward pair of wheels will be increased, while the resistance to the rotation of the rear wheels will be merely nominal.

It will be observed that, if, in Fig. 4, the wheels rotate in the opposite direction, through motion of the car in the opposite direction, what has been considered the rear pair of wheels will now become the forward pair. At the same time, also, the effect of the inclined hangers upon the two pairs of wheels has been reversed, so that it is still, under the changed conditions, the leading pair of wheels which is subjected to the greatest brakeshoe pressure, and the rear pair of wheels which is subjected the reduced pressure. Here, then, is a method of utmost simplicity which fulfills the requirements of the case.



A most important feature of this method will, doubtless, not have escaped observation. This feature consists of the fact that the conditions prevailing in Fig. 4 are those for brakes which are hung between the wheels. As a foremost consideration it is necessary, in order to realize the advantage of the principle of inclined brake hangers, that the brakes shall be inside hung. It has been the practically universal custom to suspend the brakebeams of passenger trucks outside of the wheels. This is radically wrong if proper efficiency of the brakes is desired. The most important advantage [of inside hanging] is that the brakeshoe pressure upon the different pairs of wheels may be so proportioned that in an emergency application of the brakes trains may be stopped in from 10 to 15 per cent. shorter distance without any increased liability of injurious wheel sliding. This advantage is, of itself, so important as to overshadow all objections.

Another important advantage is the smoothness with which passenger train stops may be made. The tilting action of the ordinary passenger truck, during an application of the brakes, and the resulting jolt at the stop, has commonly been observed.

Still another most excellent feature of inclining the brake hangers is the fact that the weight of the brakebeams and attached parts thereby tends to swing the brakeshoes away from the wheels after release of the brakes.

The inside hung brake gear for passenger trucks is not only more compact and simple, but it is less costly in construction and maintenance. It enables brakeshoe slack to be taken up more evenly and completely. It enables the proper braking power—and thus the full efficiency of the brakes—to be calculated with greater certainty. In connecting and disconnecting the brake gear upon the truck there is no resistance of release springs to be overcome, and the removal and replacement of brakeshoes is thereby facilitated.

Brake gear.	Wheels.	Inclination of hanger to tangent.	Braking power, in percentage of weight.	Total brakeshoe friction in percentage of weight.
Freight, inside from truck.....	33-in. cast iron.	31° 53'	95.2	24.8
Passenger, inside from truck.....	36-in. steel tired.	32° 20'	110.4	25.2
Passenger, inside from truck.....	33-in. cast iron.	28° 2'	91.7	25
Freight, outside from car.....	33-in. cast iron.	25° 49'	80.7	22.8

It will be interesting to now compare the braking force and the retarding friction of the brakeshoes under the various conditions heretofore existing in practical service. The figures given in the tables are those computed by the methods given in the appendix,

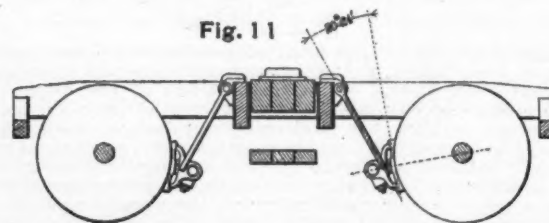
and the braking power and total brakeshoe friction given are those which will produce the same tendency to slide wheels in each case. The braking power given is computed to the highest which, under normal conditions of air pressure and brake cylinder piston travel, will result in no harmful sliding of wheels, under the average condition of service.

Brake gear.	Size and kind of wheels.	Braking power in percentage of weight.	Total brakeshoe friction in percentage of weight.
Freight, inside, truck frame.	33-inch cast iron.	88.8	19.7
Passenger, outside, truck frame.....	36-inch steel tired.	88.	20.8
Passenger, outside, truck frame.....	33-inch cast iron.	76.5	20.8
Freight, outside, car body...	33 inch cast iron.	70.4	20.4

It will be observed that in freight service a somewhat greater braking power may be employed, causing a slightly greater retarding friction when the brakebeams are hung from the car body. This is because less weight is transferred from one pair of wheels of the truck to the other pair than when the brakes are inside hung. When the brake hangers are inclined, however, this form of brake gear is notably inferior, as shown by the following table of maximum inclinations:

The surprising effect of the angularity of the brake hangers, in permitting a greatly increased braking power without increasing the danger of sliding wheels, will be at once recognized by comparing the figures in this table with those in that last preceding. The real value of the inclination of the brake hangers is, however, to be discovered by comparing the retarding frictions of the brakeshoes upon the wheels. The efficiency of the brakes has been increased from 20 to 25 per cent. in each case, except that in which the brakes are hung from the car body, where the increased efficiency is only about 12 per cent.

Fig. 9 illustrates the application of inside brakes with inclined hangers to a Canadian Pacific passenger truck. In this case, the angle of inclination, when shoes and wheels are new, is 15 degrees 49 minutes, and the length of the brake hanger is 18 inches, the form of brakehead shown being necessary on account of the posi-



tion of the equalizer spring seat. The calculated braking force is about 95 per cent. of the weight of the car, and the total maximum friction of the brakeshoes in an emergency application is about 22.9 per cent. of the weight of the car. The stopping efficiency is theoretically about 10 per cent. greater than if the brakes had been hung in the ordinary way. A train of Canadian Pacific cars, with this truck brake equipment, was tested upon the main line of the road near Montreal. The day was a fair one and the rails in average condition. The stops were made with the high-braking power upon a portion of the cars, and a braking power of 90 per cent. upon others. The wheels of the cars with high-braking power slid during the last 10 or 15 feet of each emergency stop, and the wheels of the cars having the 90 per cent. braking power slid through about half this distance. Fearing that the brakeshoes were not yet properly fitted to the wheels to make highly efficient stops, it was requested in advance that no speed recorder be applied to the locomotive, and that no attempt be made at that time to determine the stopping efficiency of the brakes. All present were so much impressed, however, with the unusual effectiveness of the brakes, that one or two stops were made from estimated speeds, and the distance measured. Making ample allowance for errors in judgment as to speed, the stops made appeared to be about 15 per cent. shorter than any recorded passenger train stops from similar speeds.

Fig. 10 illustrates the application of inside hung brakes to the standard passenger truck of the Pennsylvania Railroad, the angle of the hanger being 19 degrees 53 minutes when the shoe and 36-inch chilled iron wheel are new. The calculated braking power is about 86 per cent. of the weight of the car, and the total maximum brakeshoe friction in an emergency application of the brakes is 23.3 per cent. of the weight of the car. The stopping efficiency of this brake gear is about 13 per cent. greater than if the brakes were applied in the ordinary way.

Fig. 11 illustrates the standard passenger truck of the Erie Railroad. The length of the brake hanger is 24 inches, and the angle of inclination is 20 degrees 24 minutes when the brakeshoes and 36-inch steel-tired wheels are new. The braking power is about 97 per cent. of the weight of the car, and the total maximum friction of the brakeshoes is 23.2 per cent. of the weight of the car. The increased stopping efficiency of this brake gear is about 13 per cent. greater than would be the case if the brakes were hung in the ordinary manner.

## The Commerce of the Great Lakes.\*

BY CHARLES E. WHEELER.

The disastrous panic of 1893 was not without its benefits. It not only revealed the necessity of a reform in our monetary system, a lesson as yet blindly unheeded by the nation, but taught as well the need of industrial economics, and along this line most commendable progress has been made. During the past three years every manufacturer's office has been a schoolroom, whose instructor has been necessity, and the lesson that of applied economics and cheaper production. Mr. Carnegie, for instance, was an apt student and learned the lesson quickly. He built a railroad from the south shore of Lake Erie to his furnaces on the Monongahela and cut the rail-carrying charge in two. He went beyond that; availing himself of the dilemma of Mr. Rockefeller, possessed accidentally of several large deposits of ore on the south shore of Lake Superior, he was able to place himself in a position as regards ore supply to compete with the world, at the same time lowering the transit cost of the ore from the mine to his railroad. Mr. Rockefeller in turn saw meagre profits, unless, availing himself of the deeper channels furnished in recent years by the government, he had larger boats to carry his ores than have been running in the trade. He built a dozen of them, and thus it happened that more than half of all the steel tonnage in the merchant marine of the United States built in 1896 was the product of our lake shipyards, and surely our pride in that we now own more than half of the merchant marine of the United States as regards boats of 1,000 tons burthen and over is quite pardonable.

Everywhere, less noticeable because on a lesser scale, the same trend towards the same end is to be found. It has not received the attention it deserves—the constant, determined, intelligent effort of the American manufacturer, during the years of financial trial, to open new markets, stop wasteful expenditures, cheapen production. With returning prosperity, he is rash who will set limitations on American trade abroad or at home, a result of the discipline of 1893, '94, '95. The growth of our export trade in the iron list is unmistakably genuine, recognized and frankly acknowledged by English competitors. The Duke of Devonshire, at the meeting of the Barrow Company Directors, spoke of it as "alarming." The *London Times*, commenting on his declaration, marvels at the magnificent scale of operations at Homestead, where it finds furnaces each producing 200,000 tons of pig iron per annum, the average capacity of the English furnaces being less than 24,000 tons per annum. During the last month or two rails for Liverpool have been coming to tidewater all rail from the Cleveland District. Nails and iron rods have been going abroad in generous quantities. The future is full of hope if unwise legislation do not create more artificial barriers than the ingenuity of the American manufacturer can overcome.

Contributing to this happy condition of affairs, the cheap transportation on the lakes has been a factor of prime importance. The transporting interests on the inland waters have not failed to meet the new situation with intelligent effort and splendid courage. It was inevitable that cheaper transportation should come. The 20-foot channel from Duluth to Buffalo is practically completed, and the invitation to larger boats and cheaper rates could not be denied. Besides, the traffic itself is of such magnitude as to compel a minimum rate. Over that course of commerce must come the nation's breadstuffs, its lumber, its iron and copper ores, in quantities that pass comprehension. The figures for 1897 are, of course, not yet complete, but there is little doubt, if any, that the most prosperous year will be equalled, even surpassed. If this proves true, over 38,000,000 tons of freight will have passed through the Detroit River in 1897. Load that freight in cars, 20 tons to the car, place the locomotive at New York and the caboose will be in New York as well, but between the two nearly 2,000,000 cars will be found, extending across the continent to San Francisco, back again to New York, again across the continent, again back to New York. It is a greater commerce than that of Liverpool or London, foreign and coastwise, greater than both combined. It exceeds the total entries and clearances in the foreign trade at New York, exceeds the total of like entries and clearances at all the seaports of the United States. I am speaking of quantities, of course, not values.

Imagine, if you can, the uses to which the freight is put, the industries it nourishes. Sixty-six per cent. of all the ores used in the United States comes through the Sault, and, notwithstanding the bright outlook and flattering showing made by the Alabama and Tennessee districts, the percentage of the total amount of ores used is not only markedly in favor of the Superior ores, but the percentage increases year by year.

Two-thirds, then, of all the ores used in this country come from the south shore of Lake Superior and are the sole source of supply of such mills as those of the Carnegie Company, the Illinois Steel Company, the Johnson Company, the Cleveland Rolling Mill Company, and others that are now confessedly equipped to compete for foreign trade. If our hope in the future supremacy of the American iron and steel maker is well-grounded, surely we may look for its justification in the furnaces between Cleveland and Pittsburgh. There, if anywhere, must be found the means by which, in an iron age, this country may assume a commanding position in the iron markets of the world.

And the whole matter depends on cheap transportation. Remove the chain of lakes and no railroad or system of railroads could hope for a moment to place the 140 different iron and steel manufacturers in the Central States district in a position to compete with foreign mills, and in the catastrophe thousands of allied industries must inevitably be abandoned. For the coal, for the coke, is in western Pennsylvania and the ores over 900 miles

away. No railroad in America is better equipped to transport freight cheaply than the Lake Shore & Michigan Southern. Its grades are light, its tracks and roadbed unsurpassed. The cost per ton-mile in 1896 on that railroad was 3.81 mills; the cost on the lakes .99 mills. We have this year reduced the latter figure fully one-third in the operation of the larger boats. We have been bringing ore from the south shore of Lake Superior to Cleveland at a rate of but 15 cents per ton over the ordinary railroad switching charge in any of our large cities. We have been taking coal back at one-third the New York lightering rate.

To reach such results has demanded the most rigid regard for economies in every direction. It has worked a revolution in loading and unloading cargoes. It became necessary that appliances should be such that 6,000 tons of ore could be loaded in a boat, the boat trimmed and ready to depart for her Eastern terminus within four hours after tying up to the dock. It became necessary that at this end of the line those 6,000 tons should be unloaded in 10 hours. It became necessary that 40 cars an hour, each car containing 25 tons of coal, should be lifted up bodily one at a time, and the contents discharged into the boat as easily as a laborer flips his shovel.

When Mr. Carnegie amazed the world last spring with his low quotations and other mills followed, let it not be forgotten that it had been impossible but for our ship yards, the genius of the mechanical engineer, and our steamship organizations, which have availed themselves of every known appliance for the economical conduct of their business. Had it not been for them and the lakes, Mr. Carnegie had sought in vain for his foreign market, Mr. Moxham had returned from Liverpool empty-handed, and the Cleveland rod and nail mills had never dreamed of Japan and England for profitable sales. The commercial supremacy of America in iron and steel manufacture is impossible but for the great lakes.

And now let it not be thought that the greater part of that traffic is the carrying of iron ores. It is nearly half of the tonnage, it is true, but in value occupies but fourth position. The total value of freight passing through St. Mary's Falls Canals in 1896 was over \$180,000,000. Of this amount wheat must be credited over \$47,000,000; flour, \$34,000,000; unclassified freight, \$31,000,000. Iron ore, with \$25,000,000, comes next, closely pushed by copper with \$23,000,000 to its credit. If the grain shipments out of Chicago and the lumber shipments from Lake Huron be added, and again there be added the value of the coal and merchandise shipments from Lake Erie to Detroit and Lake Michigan ports, the importance of iron ore in the list is not so readily recognized, and it will be seen that what I have said of the lakes and its relation to the iron industry applies quite as well to wheat, corn, oats, flour, and possibly copper.

It is almost certain that the indirect effects of lake transportation are of greater importance than the direct. Mr. Blanchard, in his argument of March, 1894, before the committee of the United States Senate on interstate commerce, made a significant and, as I believe, absolutely truthful statement in these words: "I contend," he said, "that after rivers, lakes, oceans and economic forces have spent their combined natural and national powers in determining rates which are reasonable, such rates cannot be made excessive by combination." Mr. Blanchard was defending railroad pools, a question alive to-day and destined to command careful public consideration in the years to come. As a representative of the railroad interests, his plea may be that of an advocate, yet the fact is he was entirely correct. No railroad or combination of railroads can disassociate itself from the traffic means we are considering. It is a controlling factor, and if Duluth can ship her flour from that port to Liverpool for 14½ cents per hundred—a privilege she enjoyed for a brief time the past summer—its effect is instant upon every railroad that has flour mills to protect or grain to haul to them. And then, too, it is not iron ore, flour and wheat that alone monopolize the low rate. The class freight annually carried over the lakes between the great commercial centers, Chicago, Milwaukee, Detroit, Toledo, Cleveland and Buffalo, and beyond in connection with the rail lines and the Erie Canal, is an item concerning which, unfortunately, no accurate data are at hand, thanks to a law which does not exact reports of any considerable statistical value; but the fact that all your trunk lines whose western terminus is Buffalo own and operate their own boats, and the fact before cited that the unclassified freight in the Lake Superior trade amounts in value to over \$30,000,000 per year, hint at the enormous value of the total class business transacted in the lake trade. None of the trunk lines may ignore it and its influence is far felt. If it became a traffic necessity for the Lake Shore & Michigan Central and the New York Central & Hudson River railroads to approximate the lake and rail or lake and canal rate on any commodity from Chicago to New York, be sure the other trunk lines will meet it, and give their tidewater terminals the same rate, not omitting the differentials. As was the case this summer, even the north and south lines, such as the Illinois Central, must, of necessity, take a hand, protecting their gulf termini against the competition thus forced on them. Now, while its effects are of little consequence, perhaps, in regard to higher class freight, there can be no question but all the 6,000 railroad stations east of the Mississippi and north of the Ohio River reap a decided benefit in the carrying cost of the lower class freight and commodities; for when through rail rates are reduced between Chicago and New York, for instance, because of lake competition, they are simultaneously reduced between intermediate points because of the long and short haul clause of the interstate commerce act. The effect is widespread, often disastrous to the carrier, but at least yields this comfort—that the present unmistakable tendency toward concentration of railroad interests, or the enactment by Congress of a law permitting railroads to pool, is a menace of academic rather than real interest. So long as our water highways are open, the railroads have a competition that cannot be overcome.

There is another reason why this competition is irresistible. In the building of boats and their machinery, the naval architect and marine engineer may hope reasonably to keep in advance of the

\* From a paper read before the Society of Naval Architects and Marine Engineers, Nov. 11, 1897.

maintenance of way engineer, the master car-builder, and the superintendent of motive power. Walking through the Globe shipyards one day with Mr. Parkhurst, he picked up a piece of coal the size of a walnut and remarked: "You would hardly think that little lump of coal will carry a ton of freight a mile, would you? and yet that is what it will do on our better class of boats." It is true; fifty-five hundredths of an ounce of coal per ton-mile is the record.

Now, such results are not to be expected in the performance of a locomotive; at least they are not in sight. Such economies are associated with triple and quadruple expansion engines, and it is worthy of note that for the first time in the history of shipbuilding in America we on the lakes are now building our freighters with quadruple expansion engines. Then, too, our waterways are being deepened, our boats being enlarged. Until last year they were less than 400 feet long. We are now building them 475 and 500 feet in length over all.

There is in a workshop at Cleveland an internal combustion engine built for the company with which I am associated. It weighs about two tons, and is, if I mistake not, the first compound gas-engine that successfully meets all requirements. Its cards show an indicated horse-power of 114, and a thermal efficiency of 39.5. Making no claim whatever to a technical mechanical training, I am perhaps treading on dangerous ground, but this at least is known—that, reduced to steel strains, we have an engine of 92 horse-power per ton, a record far surpassing that of the Turbinia, an engine that exhausts at atmosphere and that may be built to any power, if some of your own brightest marine engineers are not in error. In any event, it is certain that the principal of a compound gas or oil engine is now thoroughly understood, and whether the present device fulfills expectations or not, assuredly the time is not far distant when important results will come from the untiring efforts of mechanical engineers to transfer the source of power from the boiler to the cylinder. I mention it because indicative of a possible revolution in mechanics that will work economies in the engineering of a vessel impossible to the locomotive, and thus increase the already marked difference between the cost per ton mile by water and that by rail.

Clearly we have not yet sounded the possibilities of cheap transportation by water, and with their discovery one may be justified in believing that their application can nowhere be productive of more beneficent results to mankind than on those waters to which are annually consigned the products of the vast plains of the West, the nation's food and the supply of her workers in iron.

#### Painting by Compressed Air.\*

BY H. G. MAC MASTERS.

We presume that a paper on painting railway equipment with compressed air, based on every-day practice, strictly adhering to facts instead of citing what has been done or what can be done, will best serve the purpose.

After a few trials with the machine we felt perfectly satisfied that it would spray paints, be they light or heavy, the only question now being would they dry, look as well, and, above all, wear as well as paint applied with a brush? Of the first two we have satisfied ourselves that, by changing formulas somewhat for some makes of paints only, paint will dry, look as well, and, with some colors, look even better than brush work, and, as for the wearing qualities, we can only say that we have recently seen some work that has been out nearly a year, and that it looks quite as well as brush work.

However, our faith is and has been so great in the machine that every freight car, whether box, stock, coal, fruit or refrigerator, that we have painted since last November (excepting a few that were too far from air connections) have been done with it, and we are satisfied that with this method of painting we need have no fear for the wearing qualities of paint.

We made a great many tests of different makes of paints, and found the machine would spray any of them, there being no difference so far as the machine was concerned, but it was in the looks and drying qualities that we found the difference, the common faults being those of drying flat in spots, and skin or surface drying; but this was overcome in most cases by the addition of a certain per cent. of Japan oil—what per cent. can best be determined by a little experimenting, although we find one-third Japan oil and one third boiled linseed oil answers as a reducer in most cases.

Several paint concerns are now making special spraying paints that are giving very good satisfaction, particularly on old wood-work. Paint for the spraying machine should be one that dries from the bottom out, and not from the surface in.

We also made a test to determine the weights of all kinds of paints best suited for the machine, and have concluded that we should use the same judgment with the machine that we would were we going to apply the paint with the brush—for instance, if you are going to prime a car, use paint of the same consistency as you would if you were priming it with the brush, and so on with succeeding coats. If you have an old car that you only wish to give one coat, of course make it heavy.

After we got to painting freight cars in good shape, it was said that it might do for common freight cars, but it would never do for passenger cars. This may be true, so far as the body of the car is concerned, but we have proven very conclusively that it is not so with trucks.

The old method of doing trucks was to give them one coat of color and one coat of varnish, no striping. We tried the spray on them with flat or turpentine color, and then with a light varnish color, and kept increasing the varnish until they looked so well that we

concluded to discontinue the coat of varnish, and now only give them one coat. We are not only doing this on an occasional truck, but on every one, thereby saving 37½ cents on every pair of trucks over the cost of application of this varnish color by brush, as well as the cost of a coat of varnish. And still it is claimed by some it does not pay.

It has been said that if you have only one car a day to paint it does not pay to use the machine. We take it for granted, of course, that the shops are conveniently piped for air. If you can fill your machine, attach your hose, spray your car, put away the hose and clean the machine, and you have accomplished in 30 or 40 minutes what it would otherwise have taken two or three hours to do, it surely would pay. This is done nearly every day.

Some time ago we had 12 baggage car letter cases sent to the paint shop to be primed; we had a man prime one by hand, it taking him 14 minutes; then we had him spray one, which took seven minutes. It is needless to say the rest of them were sprayed, saving about 1 hour and 10 minutes. We thought that paid us.

The saving in brushes is an item well worth considering. A well-known railroad man made the remark some time ago that air painting was a fad, and would soon die out. Well, if a saving of \$800 or \$1,200 a year is a fad, it would be well for the railroads to have more faddists.

We are at present building at Burnside shops 120 new 35-foot box cars, which we are painting with the spray at a cost for labor, complete, excepting lettering, of 57½ cents.

We painted one of these cars by hand at a cost for labor, excepting lettering, of \$1.63½, using 7½ pounds of paint more than on the car sprayed.

Below is a table of comparative cost of labor painting cars by hand and with the spray, also one of passenger trucks:

COMPARATIVE COST OF LABOR, PAINTING ONE NEW 35-FOOT BOX CAR.

	With the Brush.			With the Spray.		
	Time.	Rate.	Cost.	Time.	Rate.	Cost.
Sills, 1 coat.....	20 minutes	15 cents	\$0.05	13 minutes	15 cents	.03½
Edgeroof boards, 1 coat.....	40 "	"	.10	17 "	"	.14½
Body, 3 coats.....	7 hours	"	1.05	1 h. 24 min.	"	.21
Putty .....	1 hour	"	.15	1 hour	"	.15
Roof, 2 coats.....	30 minutes	"	.07½	12 minutes	"	.13
Trucks, 1 coat....	1 hour	"	.15	20 "	"	.05
Blackening off irons, etc. ....	25 minutes	"	.06½	25 "	"	.06½
Total cost.....			1.63½			.57½

Total saving \$1.06, or 64½ per cent.

ONE SET OF PASSENGER TRUCKS.

	With the Brush.			With the Spray.		
	Time.	Rate.	Cost.	Time.	Rate.	Cost.
Trucks, 1 coat....	3 hours	15 cents	.45	½ hour.	15 cents	.07½
Total cost.....			.45			.07½

Total saving, \$0.37½, or 83½ per cent.

The above cost of painting trucks does not include sandpapering or puttying; simply the application of paint.

The saving in painting of all the freight cars is proportionately the same. Now, about the mist or fumes from air painting; this seems to be the worst or hardest feature to overcome.

We compel the operator of the machine, if working in the shop, against his will to wear a sponge over his mouth and nose, if he has more than one car to spray.

While spraying the passenger car trucks he does not use a sponge. The fumes from varnish color are less than from an oil or turpentine color.

The machine can be used to good advantage on locomotives, bridges, buildings and any number of other things that require painting where you can get air, but, having had very little practical experience in these, we leave them for others who have to write about.

#### EQUIPMENT AND MANUFACTURING NOTES.

The Richmond Locomotive Works have contracts for the special parts for converting five Class T Norfolk & Western engines to the Richmond compound type. They will also build two locomotives for the Richmond, Fredericksburg & Potomac.

At a special meeting Mr. Robert T. Lincoln was elected a Director of Pullman's Palace Car Company to succeed Mr. George M. Pullman and he was also elected Chairman of the Executive Committee which is to take charge of the affairs of the company. He will be Acting President.

The Chicago, Milwaukee & St. Paul is building a new passenger station in Minneapolis, on the site of the old one.

\* From a paper read before the Car and Locomotive Painters' Association.

The Baldwin Locomotive Works are building three locomotives for the San Francisco & San Joaquin Valley Railroad. They have orders as follows: One consolidation locomotive for the Choctaw, Oklahoma & Gulf, six consolidations for the Western Maryland, 16 consolidations for the Central Railroad of Brazil, 12 freight moguls for the Finland State Railways, six moguls and four 10-wheelers for the Grand Trunk, also one locomotive for the Norfolk, Virginia Beach & Southern and five consolidations for the Union Pacific, Denver & Gulf.

The Brooks Locomotive Works have orders for two 10-wheel locomotives for the Flint & Pere Marquette; for 12 moguls for the Kuishiu Railway of Japan, and for the boilers of 10 more 10-wheel locomotives to be built by the Chicago, Rock Island & Pacific in its Chicago shops this winter. They are now building two simple mastodon engines for the Great Northern which will have 21 by 34 inch cylinders, piston valves, 55-inch wheels and improved Bel-paire boilers to carry 210 pounds pressure and one six-wheel side tank engine for the Sanuki Railway of Japan. These builders have an additional order for one 10-wheel passenger engine for the Buffalo, Rochester & Pittsburgh like the one recently furnished to that road.

The Pittsburgh Locomotive Works are building two more locomotives for the Union Railway, a branch of the P. B. & L. E. Railway, connecting the Homestead, the Braddock and Duquesne Works of the Carnegie Steel Company.

The Cleveland, Cincinnati, Chicago & St. Louis Railroad has ordered a heavy consolidation locomotive from the Richmond Locomotive Works. It is likely that the design will be adopted as a standard of the company as a result of the economy of heavy machinery. Three sets of cylinders were also ordered, to convert that number of simple engines to the Richmond compound system, of which the road has a number already in service.

Mr. Frank W. Morse, Superintendent of Motive Power of the Grand Trunk, has sent us the following information with reference to locomotives recently ordered by that road from the Baldwin and the Schenectady Locomotive Works:

Number and date of delivery.....	18; January
Type.....	Eight 10-wheel and 10 mogul
Simple or compound.....	Single expansion
Fuel.....	Bituminous coal
Weight in working order.....	10 wheel, 156,000 pounds; mogul, 148,000 pounds
Cylinders, size.....	20 inches by 26 inches
Slide valves.....	Grand Trunk standard
Driving wheels, diameter outside of tire.....	10-wheeler, 68 inches, and mogul, 62 inches
Driving-wheel centers.....	Main centers, cast steel; leaders and trailers, cast iron
Tires.....	American manufacture
Engine truck wheels.....	Mogul, 37 inches; 10-wheeler, 33 inches; cast-iron centers; steel-tired Mansell retainers; American manufacture
Boiler.....	Extended wagon-top
Outside diameter at smallest ring.....	64 inches
Working pressure.....	200 pounds
Boiler covering.....	Wood covered with asbestos paper
Firebox.....	Toboggan above frames
Firebox length.....	120 inches; width, 43 inches; depth, 26 inches
Tubes.....	Number, 300; diameter, 2 inches
Heating surface, tubes.....	Mogul, 1,742.25 square feet; 10-wheel, 2,325.25 square feet
" " firebox.....	Mogul, 181.25 square feet; 10-wheel, 181.25 square feet
" " total.....	Mogul, 1,926.50 square feet; 10-wheel, 2,409.50 square feet
Grate surface.....	Mogul, 33.43 square feet; 10-wheel, 33.43 square feet
Tender wheels, number.....	Eight; diameter, 33 inches
Tender frame.....	10-inch channel iron
Water capacity.....	4,500 gallons; coal, 10 tons
Metallic packing.....	Yes
Bearings.....	Bronze
Brakebeams.....	Metallic
Brakes.....	Westinghouse
Train signal.....	Westinghouse

Mr. Charles Parsons, Receiver of the Ogdensburg & Lake Champlain Railroad, has placed an order with the Schenectady Locomotive Works for three compound consolidation freight locomotives for the Ogdensburg & Lake Champlain Railroad. These will have cylinders 22 and 34 inches diameter, and 28 inches stroke. The driving wheels will be 54 inches in diameter, and the engines are to weigh 150,000 pounds. The engines are to be operated on the heavy grade between Moira and Rouse's Point. The engines are of the latest design, have cast-steel driving-wheels and all the modern improvements, cast and pressed steel being used largely in order to give the maximum size of boiler obtainable with the above weight. The boiler pressure is to be 200 pounds per square inch.

The Pennsylvania Railroad is building five more Class H. 4 locomotives in its own shops.

The Chicago, Rock Island & Pacific will build 10 more 10-wheel class 25A locomotives at the Chicago shops this winter. The boilers will be built by the Brooks Locomotive Works, and the steel castings, except the driving wheels, will be furnished by the Sargent Company, of Chicago.

The St. Charles Car Company has an order for 100 additional freight cars, and one for 100 ventilator cars from the St. Louis Southwestern. This company also has an order for 250 cars for the Illinois Central.

The Barney & Smith Car Company has orders for 10 passenger cars for the Southern Pacific, 24 passenger cars for the Astoria & Columbia River and 50 cars for the Colorado & Northwestern.

The Missouri Car and Foundry Company, of St. Louis, has an order for 100 furniture cars for the St. Louis & San Francisco.

The Michigan Peninsular Car Company is building 100 freight cars for the Chicago & West Michigan.

The Pennsylvania and Central of New Jersey have asked for bids on steel cars from the Schoen Pressed Steel Company, of Pittsburgh, and it is stated that bids on a large number of cars from 80,000 to 100,000 pounds capacity have recently been asked of this firm.

The Terre Haute Car & Manufacturing Company has received an order for 100 stock cars for the Iowa Central.

The Norfolk, Virginia Beach & Southern Railroad has ordered 18 freight cars from the South Baltimore Car Works.

The Jackson & Woodin Manufacturing Company, of Berwick, Pa., has contracted to build 100 80,000-pound capacity freight cars for the Buffalo, Rochester & Pittsburgh, and the Buffalo Car Company has an order for 100 more freight cars for the same road.

The Ohio Falls Car Company is building 25 cars for the Georgia Railroad.

The Wagner Palace Car Company has completed 31 new cars for the service between Chicago, New York and Boston.

The Pittsburgh, Bessemer & Lake Erie has ordered 400 more steel cars of 100,000-pound capacity, from the Schoen Pressed Steel Company, making 1,000 cars in all ordered from this firm.

The Harlan & Hollingsworth Company have received an order for 6 passenger and 6 sleeping cars from a South American railroad.

The Bethlehem Iron Company rolled the first armor plates ever produced by that process in this country on Nov. 17. The process was entirely successful, and promises to make a revolution in armor manufacturing. The plates rolled are for the top of the turret of the battleship *Wisconsin*. They were 30 feet long, 4 feet wide and 8 inches thick. Heretofore all the armor has been forged.

The Clayton Air Compressor Works, Brooklyn, N. Y., office Havemeyer Building, 26 Cortlandt street, New York, report that the volume of sales for the month of October is larger than for any preceding month in its history, and three times greater than the average sales for five years past. These works are now constructing one 25 horse-power compressor for 3,500 pounds pressure and one 50 horse-power compressor for 2,500 pounds pressure, for the Western Manufacturing and Oil Company, Newark, N. J. They also have orders in hand for a compound air compressor ordered by Fraser & Chalmers, of Chicago; a duplex air compressor for the Deane Steam Pump Company, Holyoke, Mass.; three duplex air compressors for compressed air shop plants, two air compressors for the Consolidated Pneumatic Tool Company, one air compressor for sand blast work, one for operating pneumatic railway signals, two compressors for air lift pumping plants, two compressors to the Shone Company, of Chicago, for their pneumatic sewerage system and one large duplex compressor for the Consolidated Gas Company, New York. This unprecedented rush of business is a satisfactory demonstration that improved times are here and a most decided recognition of the merits of the Clayton air compressing machinery.

The Pearson Jack Company has changed its office from 156 Fifth avenue, New York City, to 64 Federal street, Boston, Mass. Mr. George M. Brown, General Manager, will conduct the New York business of the company at 245 Broadway.

The floating drydock built in England for Havana, Cuba, spacious enough to accommodate the largest ironclads, arrived in Havana after its long voyage from England in the tow of a tug. The dock crossed the Atlantic without the least damage.

The Western Railway Equipment Company, of St. Louis, report having sold 180 of their Houston track sanders during the month of October to the following roads: The Western Maryland for two shops, Baltimore & Ohio; New York, Ontario & Western; Maine Central; Texas & Pacific; St. Louis Southwestern; Denver & Rio Grande; St. Joseph & Grand Island; St. Louis, Chicago & St. Paul; Missouri Pacific; Sea Board Air Line; Baltimore & Ohio Southwestern; Pittsburg, Lisbon & Western; Erie, Kansas City; Fort Scott & Memphis; Missouri, Kansas & Texas; St. Louis, Iron Mountain & Southern; Kansas City, Memphis & Birmingham; International & Great Northern; Atchison, Topeka & Santa Fe; Schenectady Locomotive Works; Baltimore Locomotive Works; Pittsburg Locomotive Works, and the Dickson Manufacturing Company.

An experiment in the use of the pneumatic spray painting machine was recently tried in New York by the Turner Machine Company of that city. The gas holders of the Equitable Gas Company, located at Fortieth street and Avenue A, were painted by these machines. After the tops of the holders were painted the men stood on the ground and painted the sides as they were raised in the filling and the fact that they were in use at the time interfered somewhat with the experiment. On one day an area of about 16,500 square feet of one of the tanks was painted by three men with two spraying machines, the labor cost being \$6.25 or less than one-half cent per square yard of surface. It is interesting to note in this connection that one man with a brush can paint only about 1,300 square feet per day.

Five American companies have combined to make steel tubing in this country and the new concern will have a minimum capacity of 50,000,000 feet per year. This is equivalent to 90 per cent. of the total output of this country. According to a correspondent from Toledo, the concerns are the Brewer Seamless Tube Company and the American Weldless Tube Company, of Toledo; the Shelby Tube Company, Shelby, O.; the Ellwood Tube Company, Ellwood, Pa. and the Greenwood Tube Company, Greenwood, Pa. W. H. Millers of Shelby, will be the President and General Manager. The company will be known as the Shelby Steel Tube Company, and its capitalization is \$5,000,000.

The Sterlingworth Railway Supply Company have recently received the following orders for Sterlingworth rolled steel brakebeams: D., L. & W. Ry., 2,500; Southern Ry., 4,000; Swift & Co., 3,000; Cincinnati Southern, 800; Central of Georgia, 800; Norfolk & Western, 4,000; St. Louis & San Francisco, 800; Lehigh Valley, 350; George's Creek & Cum., 400; Ohio Central, 500; West Va., Cent. & Pitts., 300; Wheeling & Lake Erie, 500; Manhattan Oil Co., 500; Atlantic Coast Line, 400; N. Y., O. & W., and smaller orders from some 25 additional roads.

The Newport News Ship Building and Dry Dock Company, of Newport News, Va., are erecting at their shipyard a crane capable of lifting 110 tons. This crane is to be used for the placing of engines, boilers and other machinery in the large war vessels which they are constructing for the government, and will be also used for placing the armor plates on the sides of these vessels, some single pieces of which weigh from 40 to 50 tons. The crane will have sufficient reach so that it will cover the entire width of a large cruiser. This crane revolves in a circle on a turntable which is supported on a steel foundation about 25 feet high. This steel foundation is to carry, besides its own weight, the weight of the crane, its machinery, and whatever load may be lifted, which altogether will aggregate 900 tons. The steel support for this crane is being furnished and erected by the Berlin Iron Bridge Company, of East Berlin, Conn.

Coffin steel piston rods and crankpins were specified for two 10-wheel locomotives recently ordered for the Flint & Pere Marquette of the Brooks Locomotive Works.

The fiftieth anniversary of the establishment of the firm of Siemens & Halske, Electrical Engineers, was celebrated Nov. 12. Congratulations were presented by a deputation from the Berlin, Charlottenburg, Vienna, St. Petersburg and London branches, and a number of presents were offered, including a portrait of Herr Werner Siemens, painted by Koner. Herr Carl Siemens read a deed establishing a fund of a million marks for the benefit of the workmen and officers of the firm, and speeches were made by well-known members of the company and by government officials.

A gigantic wood-working combination which will control most of the wood-working machinery business of the United States, under the name of the American Woodworking Machinery Company, has just been organized at Williamsport, Pa., with a capital of \$8,500,000. The firms that have pooled their interests are Goodell & Walters, of Philadelphia; Glencoe Machine Company, of Brooklyn; Hoyt Brothers, of Aurora, Ill.; Globe Machine Company, of Chicago; Fague & Company, of Cincinnati; E. & B. Hayes Machine Company, of Oshkosh, Wis.; Frank Clements, of Rochester; C. B. Rogers & Co., of Norwich, Conn.; Milwaukee Sander Company, of Green Bay, Wis.; Levi Houston Company, of Montgomery, Ala.; Rowley & Hermance, the Williamsport Machine Company, the Lehman Machine Company, and Young Brothers, Lockhaven.

## Our Directory

### OF OFFICIAL CHANGES IN NOVEMBER.

**Baltimore and Ohio.**—Mr. E. W. Grieves has resigned as Superintendent of the Car Department, to engage in other business, and the office has been abolished; Mr. Joseph Billingham has been appointed Master Mechanic of the Pittsburgh division, with headquarters at Glenwood, Pa.; Mr. C. F. McDermott has been appointed Master Mechanic with headquarters at Garrett, Ind., to succeed Mr. Billingham, transferred.

**Charleston & Western Carolina.**—Mr. Samuel Thomas has been elected Vice-President, to succeed Mr. W. A. C. Ewen, resigned. Mr. W. J. Craig has been appointed General Manager, with office at Augusta, Ga.

**Cleveland Terminal & Valley.**—Mr. J. E. Galbraith, who has been appointed Traffic Manager, with office at Cleveland, O., will also act as General Agent of the B. & O. R. R.

**Columbus, Sandusky & Hocking.**—Mr. M. F. Bonzanco has been appointed Superintendent and Chief Engineer, with office at Columbus, O.

**Colorado Midland.**—Mr. George W. Ristine has been elected President of the reorganized company, and has had charge of the property since November 1.

**Findlay, Fort Wayne & Western.**—The general offices of this company have been removed from Fort Wayne, Ind., to Findlay, O.

**Kansas City, Pittsburgh & Gulf.**—Mr. W. J. Miller has been appointed Master Mechanic of the Southern Division, with headquarters at Shreveport, La.

**Litchfield, Carrollton & Western.**—Mr. C. B. McCall has resigned as General Manager, and the office has been abolished, and Mr. T. W. Geer has been appointed General Superintendent, with headquarters at Carlinville, Ill.

**Leamington & Eastern.**—Mr. J. G. Livingston has resigned as Purchasing Agent, to accept the position of General Superintendent of the Intercoastic.

**Louisville, Henderson & St. Louis.**—Mr. F. J. Ferry, Master Mechanic, died at Cloverport, Ky., Nov. 4, at the age of 52 years.

**Maine Central.**—Mr. A. S. Bosworth has been appointed Purchasing Agent, with office at Portland, Me., and Mr. T. L. Dunn has been appointed Chief Engineer, with office in same city.

**Montana.**—Mr. R. A. Harlow has been appointed Vice-President and General Manager.

**New York, Philadelphia & Norfolk.**—Mr. Charles W. Reiff, Traveling Passenger Agent, died at his home in Philadelphia, on Nov. 9, at the age of 39.

**Philadelphia & Reading.**—Mr. Edwin L. Moser has resigned as Mechanical Engineer.

**Peoria, Decatur & Evansville.**—Mr. Robert S. Anderson has been elected President and Mr. John H. Frail has been elected Vice-President.

**St. Louis, Chicago & St. Paul.**—Mr. Henry W. Gays has been appointed General Manager; he is also General Manager of the Chicago, Peoria & St. Louis.

**South Haven & Eastern.**—Mr. A. A. Patterson, Jr., has been chosen President. He is also President of the Milwaukee, Benton Harbor & Columbus.

**Texarkana & Fort Smith.**—Mr. C. J. Snook has been appointed General Manager, with office at Texarkana, Tex.

**Wheeling & Lake Erie.**—Mr. J. B. Braden has been appointed Superintendent of Motive Power and Cars, with headquarters at Norwalk, O., to succeed Mr. O. P. Dunbar, deceased.

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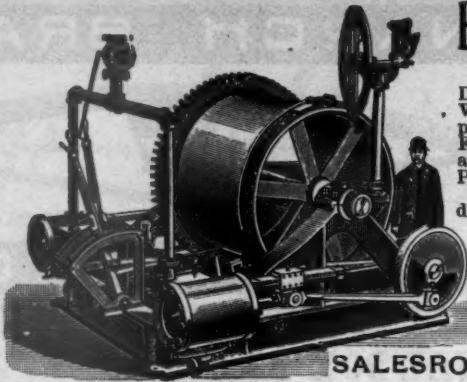
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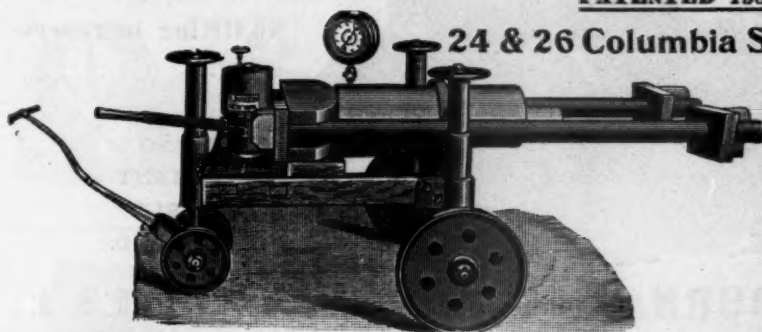
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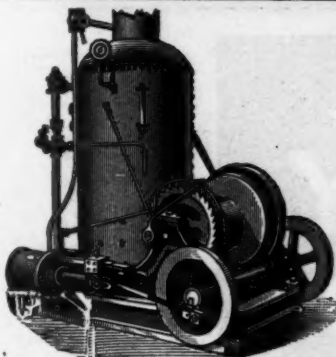


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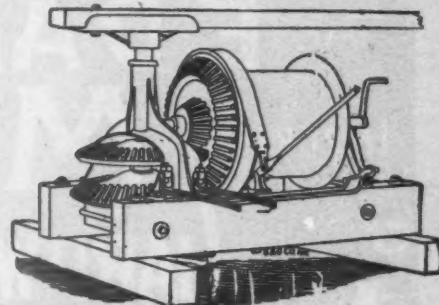
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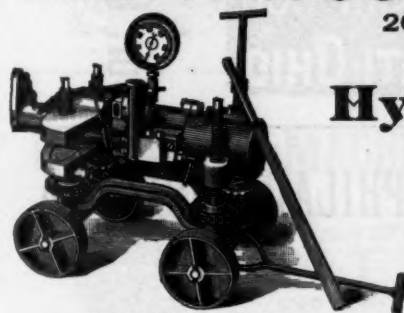
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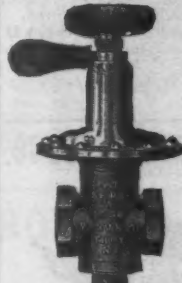
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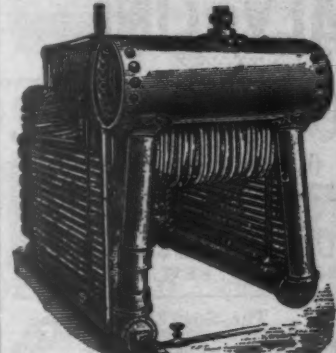
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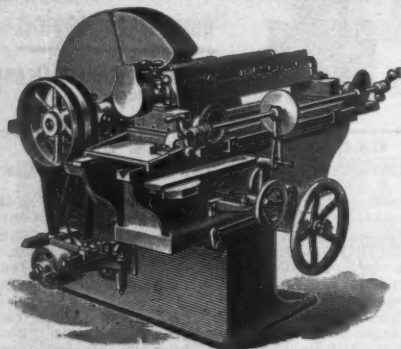
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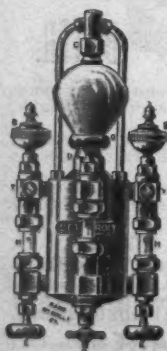
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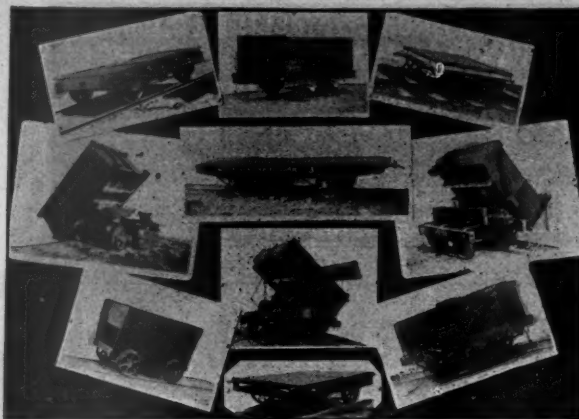
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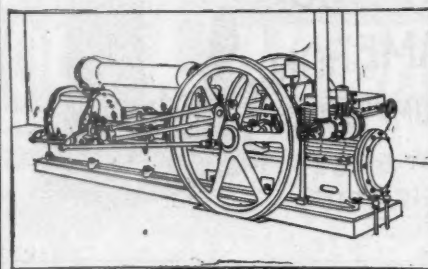
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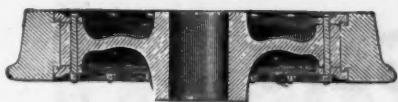
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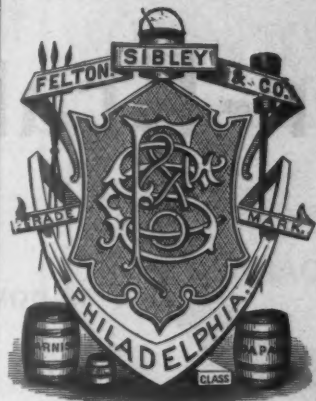
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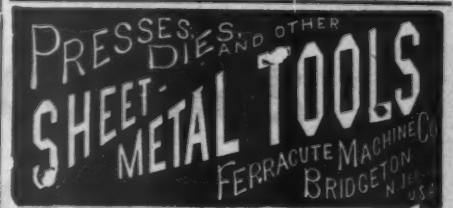
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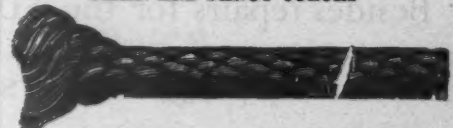
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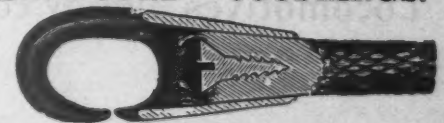
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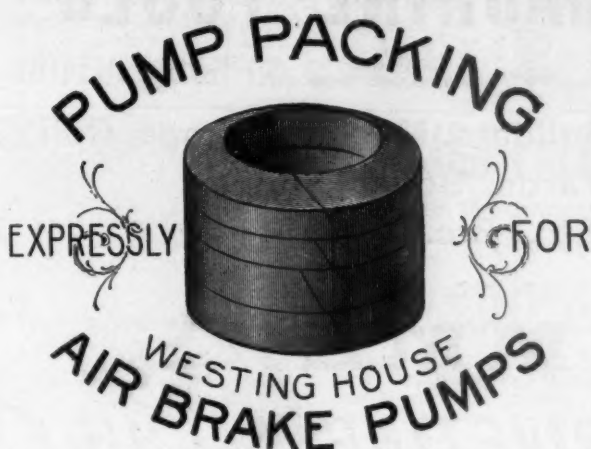
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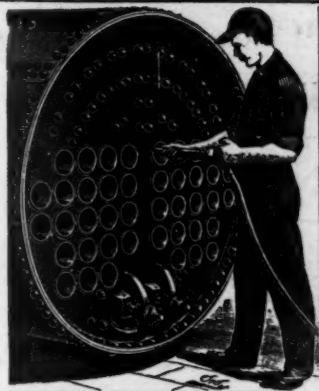
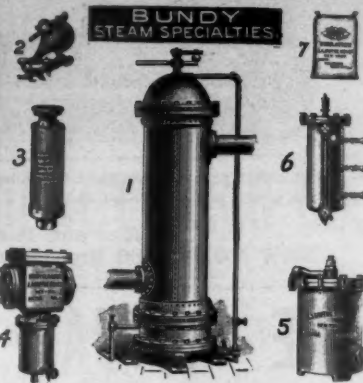
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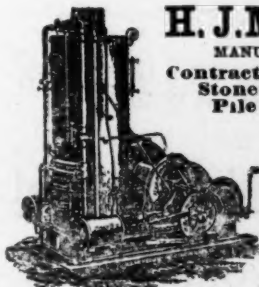
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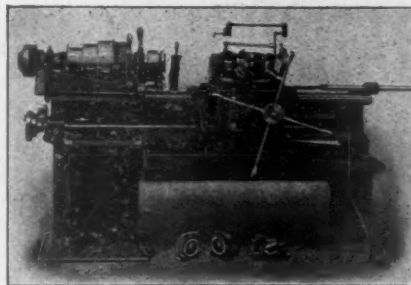
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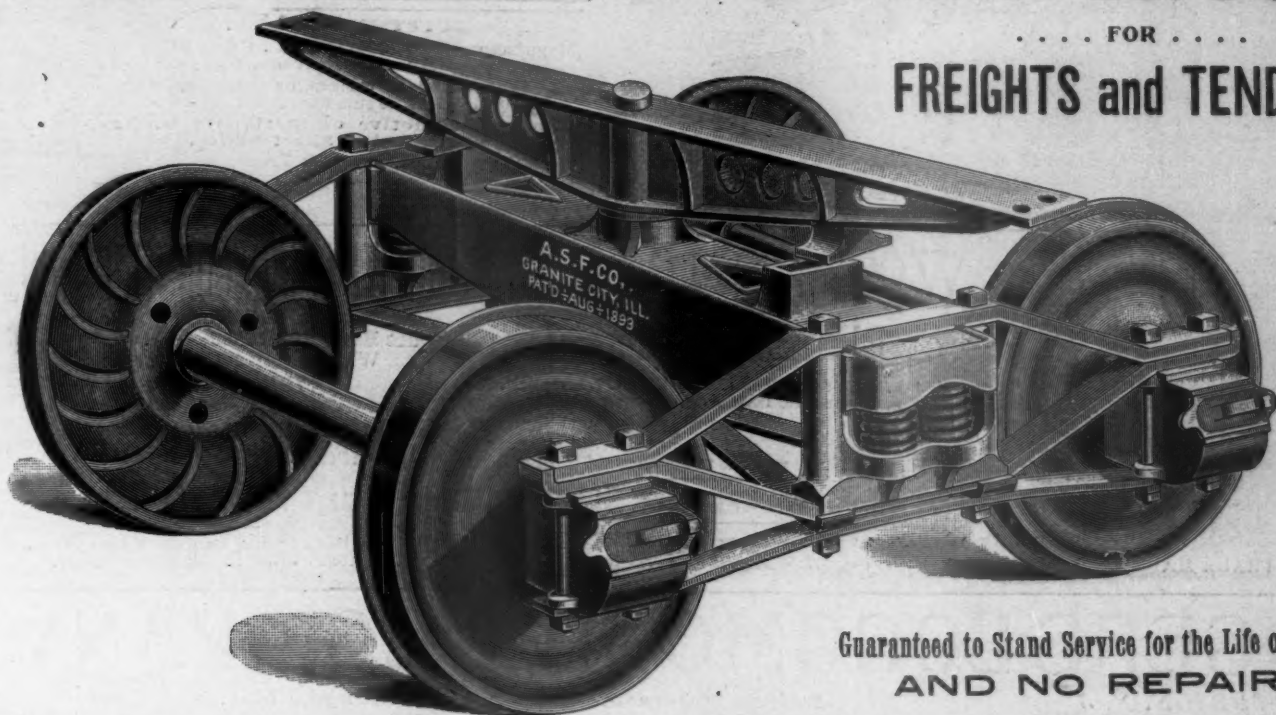
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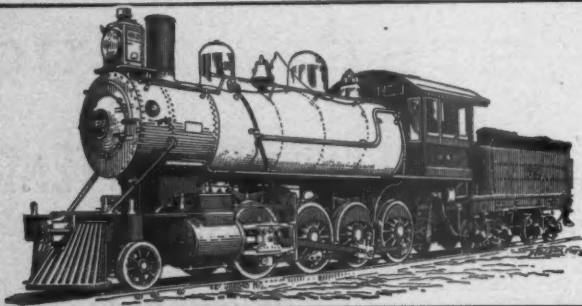


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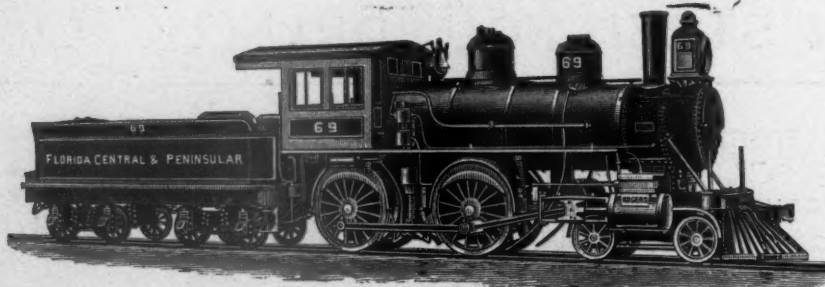
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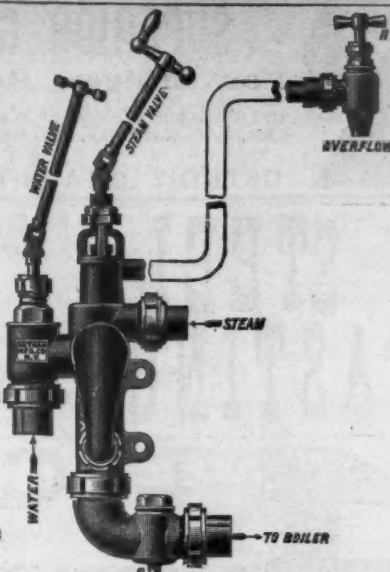
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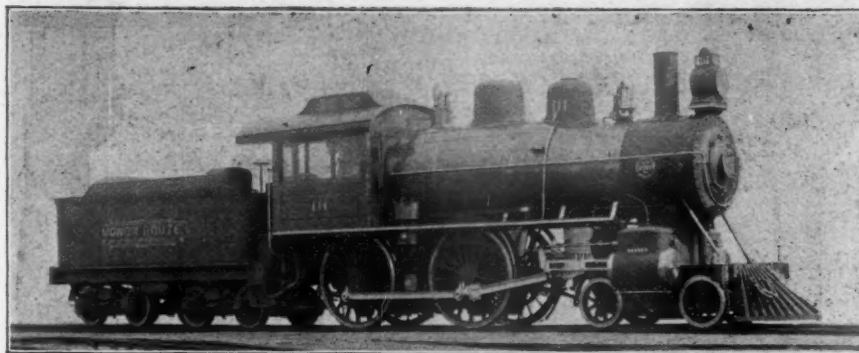
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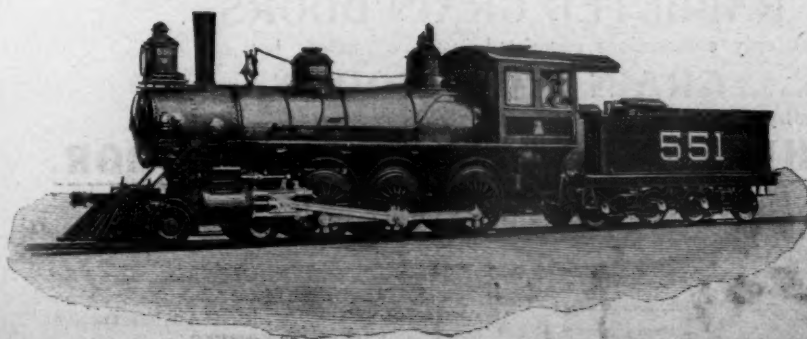
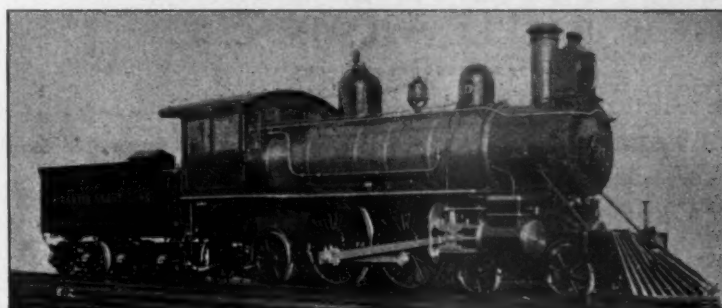
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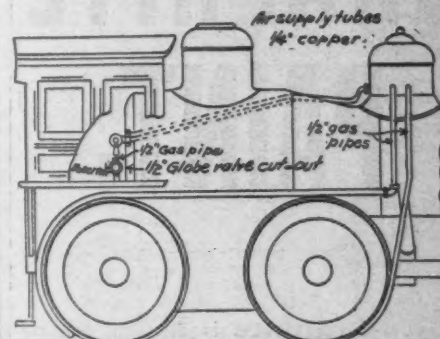
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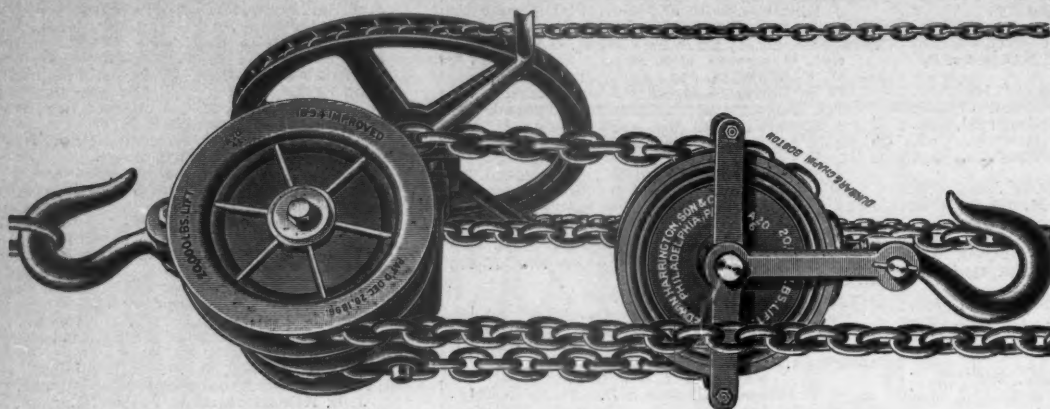
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New London Div.  
121 m. 24 lo. 382 c.  
D. Mackenzie, Supt. N. London, Ct.  
J. Hinchy, M. M. New London, Ct.  
L. Beckwith, M. C. B. New London, Ct.  
Og. & L. Cham. Div.: 4-8 1/2 g. 118m. 28 l. 1,583 c.  
Frank Owen, Supt. Ogdensburg, N. Y.  
Thos. Rumney, Div. M. M. Malone, N. Y.  
Charleston & Savannah.  
(See Plant System.)  
Charleston, Sumt. & No. R. R. 4-9 g. 153m. 11 lo. 306c.  
C. Millard, Supt. & Pur. Agt. Sumter, S. C.  
M. M. Sumter, S. C.  
Charleston & Western Carolina Ry. Co.  
4-9 g. 340 m. 25 lo. 420 c.  
W. J. Craig, Gen. Man. Augusta, Ga.  
A. W. Anderson, M. S. & P. A. Augusta, Ga.  
W. H. Stubb, M. M. & M. C. B. Augusta, Ga.  
Charlotte, Columbia & Augusta R.R. (See S. Ry. Co.)  
Chattanooga Southern R.R. 4-8 1/2 g. 92 m. 6 lo. 173 c.  
W. S. Hoskins, Gen. Man. Chattanooga, Tenn.  
H. T. Ellison, M. M. Chattanooga, Tenn.
- Chat. Home & Colum. R.R. 4-9 g. 138 m. 9 lo. 246 c.  
E. E. Jones, Rec. G. M. & Pur. A. Rome, Ga.  
M. M. Rome, Ga.  
Chateaugay R. R. 3 g. 73 m. 11 lo. 303 cars.  
J. N. Stower, G. M. & Pur. A. Plattsburg, N. Y.  
A. W. Fee, M. M. & M. C. B. Lyon Mountain, N. Y.  
Chesapeake & O. Ry. Co. 4-9 g. 1,444 m. 355 l. 14,020 c.  
Geo. W. Stevens, Gen. Man. Richmond, Va.  
W. F. La Bonta, Pur. Agt. Richmond, Va.  
W. S. Morris, Supt. M. P. Richmond, Va.  
T. S. Lloyd, M. M. Richmond, Va.  
A. F. Stewart, M. M. Huntington, W. Va.  
Chicago & Alton R.R. 4-8 1/2 g. 863 m. 240 lo. 7,804c.  
C. H. Chappell, V. P. & Gen. Man. Chicago, Ill.  
A. V. Hartwell, Pur. Agt. Chicago, Ill.  
H. Monkhouse, S. Mch. Bloomington, Ill.  
J. Townsend, M. C. B. Bloomington, Ill.  
Chicago & Calumet Terminal Ry. Co.  
(See Chicago Terminal Transfer R. R. Co.)  
Chicago & Erie R.R. (See Erie R. R.)  
Chicago & Eastern Illinois R. R.  
4-8 1/2 g. 631 m. 144 lo. 9,619 c.  
E. P. Broughton, Gen. Supt. Chicago, Ill.  
G. J. Schappert, Pur. Agt. Chicago, Ill.  
Thos. A. Lawes, S. M. P. & M. Danville, Ill.  
Chicago, Ft. Madison & Des Moines R. R.  
4-8 1/2 g. 71 m. 3 lo. 28 c.  
E. F. Potter, Gen. Man. & P. A. Ft. Madison, Ia.  
Chicago & Gr. Trunk and Det. Tr. Haven & Mil. Ry.;  
Cincinnati, Saginaw & Mackinaw R. R.; Toledo,  
Saginaw & Muskegon R. R.  
4-8 1/2 g. 763 m. 206 lo. 3,883 cars.  
(See Grand Trunk Ry.)  
Chicago & Iowa R.R. (See C. B. & Q.)  
Chicago, Lake Shore & Eastern Ry.  
4-8 1/2 g. 366.17 m. 58 lo. 2,914 cars.  
W. G. Brimmon, Gen. Man. Chicago, Ill.  
L. D. Doty, Pur. Agt. Chicago, Ill.  
C. J. Clifford, M. M. So. Chicago, Ill.  
E. B. Smith, M. C. B. So. Chicago, Ill.  
Chicago & Northern Pacific R. R. Co.  
(See Chicago Terminal Transfer R. R. Co.)  
Chicago & Northwestern Ry.  
4-8 1/2 g. 5,030.78 m. 1,010 lo. 35,911 cars.  
John M. Whitman, Gen. Man. Chicago, Ill.  
Chas. Hayward, Pur. Agt. Chicago, Ill.  
Robt. Quayle, Supt. M. P. & M. Chicago, Ill.  
W. H. Marshall, Asst. Supt., M. P. & M. Chicago, Ill.  
C. A. Schroyer, S. C. D. Chicago, Ill.  
Wis. Div.: Thos. A. Lawson, Supt. Chicago, Ill.  
J. Heath, M. M. Chicago, Ill.  
Gal. Div.: J. C. Stuart, Supt. Chicago, Ill.  
R. Erskine, M. M. Escanaba, Mich.  
Penn. Div.: W. B. Linsley, Supt. Escanaba, Mich.  
J. W. Clark, M. M. Escanaba, Mich.  
Mad. Div.: R. A. Cowan, Supt. Baraboo, Wis.  
H. D. Page, M. M. Baraboo, Wis.  
W. & St. P. Div.:  
W. P. Cosgrave, Supt. Winona, Minn.  
Wm. McIntosh, M. M. Winona, Minn.  
Ia. Div.: R. H. Aishton, Supt. Boone, Ia.  
J. Cockfield, M. M. Clinton, Ia.  
No. Iowa Div.: Wm. D. Hodge, Supt. Eagle Grove, Ia.  
Wm. Hutchinson, Foreman. Eagle Grove, Ia.  
Ashland Div.:  
C. H. Hartley, Supt. Kaukauna, Wis.  
A. W. McLean, M. M. Kaukauna, Wis.  
Dak. Div.: J. S. Oliver, Supt. Huron, S. D.  
F. M. Dean, Foreman. Huron, S. D.  
Chicago, Peoria & St. Louis R. R. Co. of Illinois.  
4-8 1/2 g. 167 m. 33 lo. 1,590 cars.  
Henry W. Gays, G. M. & P. A. Springfield, Ill.  
W. E. Killen, Supt. M. P. & M. C. B. Jacksonville, Ill.  
(See C. B. & Q.)  
Chicago, Bur. & Kan. City Ry.  
Chicago, Burlington & Northern R. R.  
4-8 1/2 g. 371 m. 58 lo. 3,420 c.  
J. R. Hastings, Gen. Supt. St. Paul, Minn.  
Geo. Hargreaves, Pur. Agt. Chicago, Ill.  
N. Frey, M. M. La Crosse, Wis.  
Chicago, Burlington & Quincy R. R.  
4-8 1/2 g. 2,175 m. 516 lo. 490 pass. 24,078 fr. cars.  
W. O. Brown, Gen. Man. Chicago, Ill.  
Geo. Hargreaves, Pur. Agt. Chicago, Ill.  
G. G. Yeomans, Asst. P. A. Chicago, Ill.  
G. W. Rhodes, Supt. M. P. Aurora, Ill.  
W. Forsyth, Mech. Eng. Aurora, Ill.  
R. D. Smith, M. M. Chicago, Ill.  
Chi. Div.: H. D. Judson, Supt. Aurora, Ill.  
A. Forsyth, M. M. Aurora, Ill.  
Galesburg Div.:  
W. B. Throop, Supt. Galesburg, Ill.  
R. W. Colville, M. M. Galesburg, Ill.  
St. L. Div.: W. G. Besler, Supt. Beardstown, Ill.  
J. A. Carney, M. M. Beardstown, Ill.  
Ia. & Mo. Lines: C. M. Levey, Supt. Burlington, Ia.  
J. F. Deems, M. M. W. Burlington, Ia.  
East. Div.: O. E. Stewart, Supt. Ottumwa, Ia.  
J. E. Button, M. M. Ottumwa, Ia.  
West. Div.: J. H. Dugan, Supt. Creston, Ia.  
E. Jones, M. M. Creston, Ia.  
Bur. & Mo. R. R. in Neb.:  
4-8 1/2 g. 3,515.4 m. 333 lo. 274 pass. 8,609 fr. c.  
G. W. Holdrege, Gen. Man. Omaha, Ne.  
D. Hawksworth, Supt. M. P. Plattsmouth, Neb.  
E. S. Gruesel, M. M. Havelock, Neb.  
R. T. Smith, M. M. Lincoln, Neb.  
A. B. Pirie, M. M. Wymore, Neb.  
R. B. Archibald, M. M. McCook, Neb.  
J. P. Reardon, M. M. Alliance, Neb.  
Chicago, Indianapolis & Louisville Ry.  
4-8 1/2 g. 587 m. 97 lo. 6,077 cars.  
W. H. McDoel, V. P. & G. M. Chicago, Ill.  
E. E. Taylor, Pur. Agt. Chicago, Ill.  
Henry Watkins, M. M. Lafayette, Ind.  
Chas. Collier, M. C. B. Lafayette, Ind.  
Chicago, Iowa & Dakota Ry. 4-8 1/2 g. 27 m. 21. 18 c.  
H. C. Stuart, Gen. Man. & Pur. A. Eldora, Ia.  
Thos. D. McDonald, M. M. Eldora, Ia.  
Chicago, Kalamazoo & Saginaw Ry.  
4-8 1/2 g. 45 m. 4 lo. 18 cars.  
Jas. H. Dowing, V. P. & G. M. Kalamazoo, Mich.  
H. C. Potter, Pur. Agt. Kalamazoo, Mich.
- Chicago, Milwaukee & St. Paul Ry.  
4-8 1/2 g. 6,154 m. 852 lo. 28,965 cars.  
A. J. Earling, 2d V. P. & G. M. Man. Chicago, Ill.  
J. T. Crocker, Pur. Agt. Chicago, Ill.  
J. N. Barr, Supt. M. P. & C. D. Milwaukee, Wis.  
A. E. Manchester, A. S. & M. P. Milwaukee, Wis.  
Geo. Gibbs, Mech. Eng. Milwaukee, Wis.  
J. J. Hennessey, M. C. B. Milwaukee, Wis.  
Geo. H. Brown, M. M. Dubuque, Ia.  
John Taylor, M. M. Minneapolis, Minn.  
N. S. Kimball, M. M. Green Bay, Wis.  
Chicago, Paducah & Memphis R. R.  
(See Chicago & Eastern Illinois R. R.)  
Chicago, Rock Island & Pac. Ry.  
4-8 1/2 g. 3,571.41 m. 554 lo. 16,776 cars.  
W. H. Truesdale, 2d V. P. & G. M. Man. Chicago, Ill.  
F. A. Marsh, Pur. Agt. Chicago, Ill.  
Geo. F. Wilson, S. M. P. & E. Chicago, Ill.  
L. T. Canfield, M. C. B. Chicago, Ill.  
J. W. Fitzgibbon, Asst. S. M. P. & E., Horton, Kan.  
Lines East of Missouri River:  
Ill. Div.: C. L. Nichols, Supt. Blue Island, Ill.  
John Gill, M. M. Chicago, Ill.  
A. Chids, M. C. B. Chicago, Ill.  
East Iowa Div.:  
Wm. H. Stocks, M. M. Rock Island, Ill.  
Ia. Div.: W. M. Hobbs, Supt. Des Moines, Ia.  
J. B. Kilpatrick, M. M. Valley Junction, Ia.  
Des. M. Val. Div.: C. N. Gilmore, Supt. Des Moines, Ia.  
J. B. Kilpatrick, M. M. Valley Junction, Ia.  
So. Wn. Div.: W. J. Lawrence, Supt. Trenton, Mo.  
A. L. Studer, M. M. Trenton, Mo.  
Lines West of Missouri River:  
A. S. M. P. & E. Horton, Kan.  
Chicago, St. Louis & Pittsburgh R.R. (See Penn. Co.)  
Chicago Great Western Ry.  
4-8 1/2 g. 932 m. 147 l. 4,975 c.  
Samuel C. Stickney, Gen. Man. St. Paul, Minn.  
A. D. Ward, Pur. Agt. St. Paul, Minn.  
Tracy Lior, M. M. & M. C. B. St. Paul, Minn.  
Chicago, St. Paul, Minneapolis & Omaha Ry.  
4-8 1/2 g. 1,492 m. 269 lo. 9,167 cars.  
Walter A. Scott, Gen. Man. St. Paul, Minn.  
W. H. S. Wright, Pur. Agt. St. Paul, Minn.  
J. J. Ellis, M. M. St. Paul, Minn.  
H. L. Preston, M. C. B. Hudson, Wis.  
Chicago & South Eastern Ry. 4-8 1/2 g. 110m. 11 lo. 100c.  
H. Crawford, Jr., Gen. Man. & Pur. Agt. Chicago, Ill.  
W. C. Halfman, M. M. Lebanon, Ind.  
Chicago Terminal Transfer R. R. Co.  
4-8 1/2 g. 160.8 m. 44 l. 356 cars.  
E. S. R. Ainslie, Pres. & G. M. Chicago, Ill.  
W. B. Mallette, Pur. Agt. Chicago, Ill.  
E. A. Knowlton, Supt. & M. M. Chicago, Ill.  
Chicago & Texas R. R. Co.  
4-8 1/2 g. 75 m. 10 lo. 302 cars.  
O. L. Garrison, V. P. St. Louis, Mo.  
S. L. Sherer, Pur. Agt. St. Louis, Mo.  
Geo. W. Underhill, For. Car Shops, Murphysboro, Ill.  
Chicago & Western Indiana R. R. Co. and The Bell Ry. Co. of Chicago.  
4-8 1/2 g. 55 m. 45 l. 190 cars.  
B. Thomas, Pres. & Gen. Man. Chicago, Ill.  
C. C. Nash, Pur. Agt. Chicago, Ill.  
P. H. Peck, M. M. Chicago, Ill.  
Chicago & West Michigan Ry., and Detroit, Grand Rapids & Western R.R.  
4-8 1/2 g. 419.39 m. 47 lo. 2,102 cars.  
Chas. M. Heald, Pres. & G. M. Gr'd Rapids, Mich.  
Russell Wallace, Pur. Agt. Grand Rapids, Mich.  
B. Hasbick, S. M. P. Grand Rapids, Mich.  
W. T. Rupert, M. M. Muskegon, Mich.  
Choctaw Oklahoma & Gulf Ry.  
4-8 1/2 g. 219 m. 15 lo. 1,350 cars.  
Henry Wood, Gen. Man. So. McAlester, I. T.  
H. E. Yarnall, Pur. Agt. So. McAlester, I. T.  
J. Cunningham, M. M. & M. C. B. So. McAlester, I. T.  
Cin. & Muskingum Valley Ry.  
4-9 g. 148.45 m. 20 l. 394 c.  
C. M. Bennett, Supt. Zanesville, O.  
H. O. Hukill, Pur. Agt. Pittsburgh, Pa.  
Wm. Meikle, Genl. For. Shops. Lancaster, O.  
Cincinnati & Northwestern R. R.  
4-8 1/2 g. 14 m. 2 lo. 40 cars.  
R. Simpson, Gen. Man. & Pur. Agt. Cincinnati, O.  
O. K. Simpson, M. M. Cincinnati, O.  
Cincinnati & Westwood R. R. 4-8 1/2 g. 9 m. 2 lo. 9 c.  
J. N. Gamole, G. M. & P. A. Cincinnati, O.  
Cin., Georgetown & Portsmouth. 3 g. 42 m. 5 lo. 80 c.  
E. W. White, G. M. & Pur. Agt. Cincinnati, O.  
J. M. Myers, Supt. Cincinnati, O.  
P. T. Dunn, F. of Shops & M. C. B. Cincinnati, O.  
Cincinnati, Hamilton & Dayton; Dayton & Mich.;  
Cin., Ham. & Ind.; Columbus, Fledlay & North-  
ern; Bowling Green, Cincinnati & Dayton R. R's.  
4-8 1/2 g. 651.6 m. 174 l. 9,158 cars.  
Chas. G. Waldo, Gen. Man. Cincinnati, O.  
G. R. Balch, Pur. Agt. Cincinnati, O.  
C. H. Cory, Supt. M. P. & M. Lima, O.  
A. J. Ball, Asst. Supt. M. P. & M. Cincinnati, O.  
H. H. Swift, Gen. Car. For. Lima, O.  
A. J. Ball, Div. M. M. Dayton, O.  
Div. M. M. Cincinnati, O.  
Cincinnati, Jackson & Mackinaw Ry.  
4-8 1/2 g. 403 m. 34 lo. 1,435 cars.  
F. B. Drake, Rec. Gen. Man. & P. A. Toledo, O.  
A. H. Watts, M. M. Van Wert, O.  
Cin., Leb. & North. Ry. 4-8 1/2 g. 81.1 m. 6 l. 56 c.  
Jos. Wood, Pres. Cincinnati, O.  
Ralph Peters, Supt. Cincinnati, O.  
Jos. Underwood, M. M. & M. C. B. Cincinnati, O.  
Cincinnati, New Orleans & Texas Pacific Ry. Co.  
4-8 1/2 g. 338 m. 103 l. 4,041 cars.  
S. M. Nelson, Pres. & Rec. Cincinnati, O.  
Geo. W. Stevens, Supt. Car Service & P. A., Somerset, Ky.  
J. P. McCuen, Supt. M. P. Ludlow, Ky.  
Cincinnati Northern R. R. Co.  
4-8 1/2 g. 247 m. 24 lo. 1,063 cars.  
F. B. Drake, Gen. Man. & P. A. Van Wert, O.  
A. H. Watts, M. M. & M. C. B. Van Wert, O.

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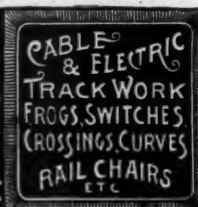
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4-8½ g. 112 m. 13 lo. 185 cars.  
Sam'l Hunt, Pres. & Gen. Man. Cincinnati, O.  
T. Hunt, Pur. Agt. Cincinnati, O.  
John C. Homer, M. M. & C. B. Portsmouth, O.  
Cincinnati, Richmond & Chil. R. R. (See C. St. L. & P.)  
Cincinnati, Saginaw & Mackinaw R. R.

## Cin., Wabash &amp; Mich. Ry. (See C. C. C. &amp; St. L. R. R.)

## Clarendon &amp; Pittsford Ry. 4-8½ g. 12 m. 3 l. 113 c.

F. D. Proctor, Gen. Mgr. Proctor, Vt.  
G. H. Davis, M. M. Proctor, Vt.  
G. H. Boyce, Pur. Agt. Proctor, Vt.

## Cleveland, Akron &amp; Columbus Ry.

4-9 g. 177 m. 37 lo. 2 946 cars.  
Calvin S. Brice, Pres. New York, N. Y.

T. H. Perry, Pur. Agt. Indianapolis, Ind.  
B. F. Marshall, M. M. & C. B. M. Vernon, O.

Cleve. Cant. & South R. R. 4-8½ g. 210 m. 37 l. 2,708 c.  
J. W. Wardwell, Rec. & Man. Cleveland, O.

H. A. Kennedy, Gen. Supt. Canton, O.  
John Bean, M. M. & C. B. Canton, O.

Cleveland & Marietta Ry. 4-8½ g. 110.78 m. 23 l. 1,012 c.  
W. A. Baldwin, Pres. G. M. & P. A. Cambridge, O.

J. Glaser, M. M. & C. B. Cambridge, O.  
Cleveland & Pittsburgh (See Penna. Co.)

Clev., Cin., Chi. & St. Louis Ry.:  
4-8½ g. 2,345 m. 528 lo. 14,720 cars.

C. E. Schaff, Gen. Man. Cincinnati, O.  
A. M. Stimson, Pur. Agt. Cincinnati, O.

William Garstang, Supt. M. P. Indianapolis, Ind.  
Cinn.-Sandusky Div.:

Thos. J. English, Supt. Springfield, O.  
Mason Ricketts, M. M. Delaware, O.

Clev. & Indianapolis Div.:

T. J. Higgins, Supt. Cleveland, O.  
E. E. Hudson, M. M. Bellefontaine, O.

St. Louis Div.:

W. G. Bayley, Supt. Mattoon, Ill.  
W. P. Urland, M. M. Mattoon, Ill.

Chicago Div.:

G. W. Bender, Supt. Indianapolis, Ind.  
F. M. Lawler, M. M. Brightwood, Ind.

Cairo Div.:

Wm. Quinn, Supt. Mt. Carmel, Ill.  
H. Hudson, M. M. Mt. Carmel, Ill.

D. E. Ry.: J. A. Barnard, Gen. Man. Urbana, Ill.  
P. J. McClurg, M. M. Urbana, Ill.

Mich. Div.: S. T. Bilzard, Supt. Wabash, Ind.  
Frank J. Zerbee, M. M. Wabash, Ind.

Cleveland, Lorain & Wheeling Ry.  
4-8½ g. 192 m. 61 lo. 4,674 cars.

W. R. Woodford, Gen. Man. Cleveland, O.  
F. E. Now, Pur. Agt. Cleveland, O.

James A. Graham, M. M. Lorain, O.  
F. H. Stark, M. C. B. Lorain, O.

Cleveland Terminal & Valley R. R.  
4-8½ g. 76 m. 36 lo. 1,054 cars.

J. T. Johnson, Gen. Supt. & Pur. Agt.,  
E. Kennerdell, G. For. Shops. Cleveland, O.

Colorado Eastern R. R. Co. 3 g. 17 m. 2 lo. 11 cars.  
C. M. Wicker, Gen. Man. Denver, Col.

H. McDowell, Gen. Pur. Agt. Denver, Col.  
H. Twining, M. M. & C. B. Denver, Col.

Colorado Midland Ry.  
4-8½ g. 342 m. 54 l. 39 pass. and 1,479 frt. c.

Geo. W. Ristine, Pres. & Man. Denver, Col.  
A. L. Humphrey, Supt. M. P. Colorado City, Col.

Columbia & Greenville R. R. (Rich. & Danville.)  
Columbia & Puget Sound R. R.

(See Oregon Improvement Co.)  
Columbus Southern Ry.

(See Georgia & Alabama Ry.)  
Columbus, Sandusky & Hocking R. R.

4-8½ g. 325 m. 50 lo. 3,562 c.  
S. M. Felton, Rec. Cincinnati, O.

L. W. Neeramer, A. Secy. & P. A. Sandusky, O.  
F. P. Boatman, M. M. Columbus, O.

W. J. Miller, G. For. Mac. Dept. Columbus, O.  
John Wohls, G. For. Car Dept. Columbus, O.

Columbus & Rome R. R. (See Cent. of Ga.)  
Columbus, Hocking Valley & Toledo Ry.

4-8½ g. 347 m. 105 lo. 7,810 cars.  
N. Monsarrat, V. P. & Rec. Columbus, O.

C. B. Duffy, Pur. Agt. Columbus, O.  
S. S. Stuffer, M. M. Columbus, O.

Colusa & Lake R. R. 3 g. 22 m. 3 lo. 30 cars.  
E. A. Harrington, Gen. Supt. & P. A. Colusa, Cal.

M. E. Burrows, M. M. Colusa, Cal.  
T. Sullivan, M. C. B. Colusa, Cal.

Concord & Montreal R. R. 4-8½ g. 530 m. 100 l. 2,632 c.  
(See Boston & Maine.)

Conn. Riv. R. R. 4-8½ g. 130 m. 55 lo. 688 c.  
(See Boston & Maine.)

Cooperstown & Charlotte Valley R. R.  
4-8½ g. 25 m. 3 lo. 25 cars.

D. E. Siver, Pres. & Pur. A. Cooperstown, N. Y.  
A. Gardner, M. M. Cooperstown, N. Y.

Cornwall R. R. 4-8½ g. 31.1 m. 5 lo. 9 pass. c.  
E. C. Freeman, Gen. Man. Lebanon, Pa.

A. M. Patch, Treas. & Pur. Agt. Cornwall, Pa.  
A. J. Reed, M. M. Lebanon, Pa.

Levi Blouch, M. C. B. Lebanon, Pa.  
Cornwall & Lebanon R. R.

4-8½ g. 45 m. 10 lo. 540 cars.  
A. D. Smith, Gen. Supt. & P. A. Lebanon, Pa.

R. T. Spotten, M. M. Lebanon, Pa.  
Coudersport & Port Alleghey R. R.

4-8½ g. 45 m. 3 lo. 80 cars.  
B. A. McClure, G. Supt. & P. A. Coudersport, Pa.

Cressen & Clearfield County and N. Y. Short Route.  
(See Pennsylvania Ry.)

Crooked Creek R. R. & Coal Co.  
4-8½ g. 22.41 m. 2 lo. 23 cars.

W. C. Willson, Pres. & Gen. Man.,  
Webster City, Ia.

Cumberland & Maurice River Ry. (See Cent. Ry. of N. J.)  
Cumberland & Penn. R. R. 4-8½ g. 72 m. 25 lo. 554 c.

Lewis M. Hamilton, Gen. Man. & P. A.,  
Cumberland, Md.

H. T. Bruck, M. M. & C. B. Mt. Savage, Md.  
Cumberland Valley R. R. 4-9 g. 164 m. 34 lo. 704 cars.

J. F. Boyd, Supt. & P. A. Chambersburg, Pa.  
J. Lawrence, M. M. Chambersburg, Pa.

C. Wioke, M. C. B. Chambersburg, Pa.  
Danville & Western Ry.

3 g. 83 m. 6 lo. 72 c.  
A. B. Andrews, Pres. Raleigh, N. C.

G. K. Griggs, Gen. Supt. & Pur. A. Danville, Va.  
W. T. Whitaker, Supt. M. P. & M. Danville, Va.

Dayton & Michigan R. R. (See Cin., Ham. & Day.)  
Delaware & Hudson Canal Co.

4-8½ g. 689 m. 340 lo. 16,186 cars.  
H. G. Young, 2d V. Pres. Albany, N. Y.

J. White Sprong, Pur. Agt. Albany, N. Y.  
R. C. Blackall, Supt. Mach. Albany, N. Y.

Susq. Div.: C. D. Hammond, Supt. Albany, N. Y.  
J. R. Skinner, M. M. Oneonta, N. Y.

Sar. & C. Divs.: C. D. Hammond, Supt. Albany, N. Y.  
J. L. Cory, M. M. Green Island, N. Y.

J. I. Drexler, M. C. B. Green Island, N. Y.  
Pa. Div.: C. R. Manville, Supt. Carbondale, Pa.

C. E. Rettew, M. M. Carbondale, Pa.  
John H. Orchard, M. C. B. Carbondale, Pa.

Del., Lackawanna & Western R. R.  
4-8½ g. 901 m. 618 lo. 29,359 cars.

Wm. F. Hallstead, Gen. Man. Scranton, Pa.  
D. Hager, Pur. Agt. New York, N. Y.

D. Brown, Man. Mach. Scranton, Pa.  
Robt. McKenna, M. C. B. Scranton, Pa.

Utica Div.: A. C. Salisbury, Supt. Utica, N. Y.  
Thos. Thatcher, M. M. Utica, N. Y.

Morris & Essex Div.: Sussex.  
A. Reasoner, Supt. Hoboken, N. J.

W. H. Lewis, M. M. Kingsland, N. J.  
J. W. Baker, Mast. Car Rep. Dover, N. J.

Oswego & Syracuse Div.:  
A. H. Schwarz, Supt. Syracuse, N. Y.

L. Kistler, M. M. Syracuse, N. Y.  
Syracuse, Binghamton & New York Div.

A. H. Schwarz, Supt. Syracuse, N. Y.  
Lewis Kistler, M. M. Syracuse, N. Y.

Buffalo Div.: J. B. Marston, Supt. Buffalo, N. Y.  
F. B. Griffith, M. M. Buffalo, N. Y.

Delaware River R. R. 4-8½ g. 20 m. 3 lo. 15 cars.  
W. S. Conner, Gen. Man. Woodbury, N. J.

E. H. Green, G. Supt. & P. A. Pennsgrove, N. J.  
J. B. Gilbert, M. M. Pennsgrove, N. J.

Denison & Washita Valley. 4-8½ g. 14 m. 1 lo. 119 c.  
Thos. Fleming, Supt. Denison, Tex.

Denver & Rio Grande R. R.  
3 and 4-8½ g. 1,666.04 m. 292 lo. 7,969 c.

E. T. Jeffery, Pres. & G. M. Denver, Col.  
C. M. Hobbs, Pur. Agt. Denver, Col.

Henry Schlacks, Supt. Mach. Denver, Col.  
Delaware, Susquehanna & Schuylkill R. R. Co.

4-9 g. 67.23 m. 29 lo. 1,521 cars.  
Luther C. Smith, Supt. Drifton, Pa.

Arthur McClellan, P. A. Drifton, Pa.  
John R. Wagner, S. M. P. & M. C. B. Drifton, Pa.

Des Moines & Kansas City Ry.  
40 m., 3 g., 72 m., 4-8½ g., 112 m. 9 lo. 212 cars.

A. C. Goodrich, V. P. & G. M. Keokuk, Ia.  
W. Augustus, Supt. Mach. Centerville, Ia.

R. D. Lewis, Pur. Agt. Keokuk, Ia.  
Des Moines, Northern & Western R. R.

4-8½ g. 156 m. 14 lo. 225 cars.  
F. C. Hubbell, Supt. & P. A. Des Moines, Ia.

W. H. Whitaker, M. M. & C. B.,  
Des Moines, Ia.

Detroit, Grand Rapids & Western R. R.  
(See Chicago & West Michigan Ry.)

Detroit & Mackinac R. R.  
4-8½ g. 263 m. 20 lo. 776 c.

J. D. Hawes, Pres. & Gen. Man. Detroit, Mich.  
M. Crocker, V. P. & Pur. Agt. Detroit, Mich.

H. T. Thomas, M. M. & C. B. E. Tawas, Mich.  
Det., Gr. H. & Mil. Ry. (See Chi. & Gr. Trunk.)

Det., Lansing & No'n and Saginaw Valley & St.  
Louis Rys. (See Chicago & W. Michigan Ry.)

Dominion Atlantic Ry. 4-8½ g. 234 m. 23 lo. 437 c.  
W. R. Campbell, Gen. Man. Kenville, N. S.

P. Giffins, Gen. Supt. & P. Agt.,  
Kenville, N. S.

W. Yould, M. M. Kenville, N. S.  
R. H. Grierson, Car For. Kenville, N. S.

Duluth, Red Wing & Southern R. R.  
4-8½ g. 28 m. 3 lo. 45 c.

L. F. Hubbard, G. M. & Pur. Agt.,  
Red Wing, Minn.

H. D. McKay, M. M. Red Wing, Minn.  
J. Lyons, M. C. B. Red Wing, Minn.

Duluth & Iron Range R. R.  
4-8½ g. 154 m. 52 l. 2,326 c.

J. L. Greetsinger, Gen. Man. & Pur. Agt.,  
Duluth, Minn.

H. S. Bryan, M. M. & M. C. B.,  
Two Harbors, Minn.

Duluth, Miss'be & North'n. 4-8½ g. 127.4 m. 26 lo. 2,090 c.  
W. J. Olcott, 1st Vice-Pres. Duluth, Minn.

S. R. Payne, Pur. Agt. Duluth, Minn.  
Wm. Smith, M. M. Duluth, Minn.

Duluth, Mississippi River & Northern R. R.  
4-8½ g. 37½ m. 7 lo. 230 cars.

J. F. Killorin, V. P., G. M. & Pur. Agt.,  
Swan River, Minn.

D. McLean, M. M. & M. C. B.,  
Swan River, Minn.

Duluth, South Shore & Atlantic Ry.  
4-8½ g. 590.79 m. 94 lo. 3,153 c.

W. F. Fitch, Gen. Man. Marquette, Mich.  
P. W. Brown, Pur. Agt. Marquette, Mich.

J. J. Conolly, M. M. Marquette, Mich.  
D. C. Mulvihill, M. C. B. Marquette, Mich.

Duluth, Superior & Western Ry.  
4-8½ g. 123 m. 5 lo. 71 cars.

Wm. F. Fitch, Gen. Man. Marquette, Mich.  
P. W. Brown, Pur. Agt. Marquette, Mich.

C. F. Ward, M. M. & C. B. Cloquette, Minn.  
Duluth & Winnipeg R. R.

(See Canadian Pacific R. R.)  
Dunkirk, Allegheny Valley & Pittsburgh R. R.

(N. Y. Cen. & H. R. R. Lessee)  
4-8½ g. 91 m. 12 lo. 111 cars.

Edgar Van Etten, Gen. Supt. Dunkirk, N. Y.  
Allen Bourn, Pur. Agt. New York, N. Y.

Eagles Mere R. R. Co. 3 g. 5 m. 3 lo. 26 cars.  
C. W. Woddrop, Pres. & Pur. Agt.,  
Hughesville, Pa.

B. H. Welch, Gen. Man. Hughesville, Pa.  
John Converse, M. M. Hughesville, Pa.

D. W. Darling, M. C. B. Hughesville, Pa.  
East Alabama Ry. (See Central of Ga.)

East & West R. R. 5-9 g. 117 m. 12 lo. 126 c.  
Chas. P. Ball, G. M. Cartersville, Ga.

B. Cowden, Pur. A. Cedartown, Ga.  
B. F. Lowther, M. M. & C. B. Cedartown, Ga.

East Broad Top R. R. & Coal Co. 3 g. 45 m. 8 lo. 323 c.  
A. W. Greenwood, Gen. Supt. & M. M.,  
Rockhill Furnace, Pa.

Eastern Kentucky Ry. 4-9 g. 36 m. 4 lo. 40 c.  
H. W. Bates, Gen. Man. & Pur. A. Greenup, Ky.

A. W. Crawford, M. M. Grayson, Ky.  
Eastern Ry. Co. of Minnesota:

(See Great Northern Ry.)  
East Tenn. & Western North Car. R. R.

3 g. 34 m. 3 lo. 112 cars.  
C. H. Nimson, Gen. Supt. Cranberry, N. C.

W. Hahn, Pur. Agt. Cranberry, N. C.  
M. W. Lindamood, M. M. Johnson City, Tenn.

East Tennessee, Virginia & Georgia Ry. (See So. Ry. Co.)  
Elgin, Joliet & Eastern Ry.

4-8½ g. 176 m. 50 lo. 2,000 cars.  
C. H. Ackert, Gen. Man. Joliet, Ill.

R. A. Dugan, Pur. Agt. Chicago, Ill.  
John Horrigan, M. M. Joliet, Ill.

E. T. Carlton, M. C. B. Joliet, Ill.  
Elgin & Havelock Ry. 4-8½ g. 27 m. 2 lo. 12 c.

J. D. Chipman, Man. & P. Agt. St. Stephen, N. B.  
A. H. Robinson, G. S. & P. A. Petitcodiac, N. B.

W. W. Killam, M. M. & C. B. Petitcodiac, N. B.  
Elmira, Cortland & Northern R. R. Co.

4-8½ g. 140 m. 23 lo. 233 c. (See L. V. R. R.)  
Erie R. R.

4-8½ g. 2,061 m. 672 lo. 686 pass. c. 28,393 frt. c.  
E. B. Thomas, Pres. New York, N. Y.

A. E. Mitchell, Supt. M. P. New York, N. Y.  
E. B. Sheffer, Pur. Agt. New York, N. Y.

Erie R. R. Div.:

C. R. Fitch, Gen. Supt. New York, N. Y.  
H. F. Baldwin, Eng. M. of W. Jersey City, N. J.

East Div.: M. W. Maguire, Supt. Jersey City, N. J.  
H. A. Childs, M. M. Jersey City, N. J.

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Susq. Div.: J. F. Maguire, Supt. Elmira, N. Y.  
I. Bond, M. M. Susquehanna, Pa.

Buff. & S. & W. Div.:

C. A. Brunn, Supt. Buffalo, N. Y.  
J. H. Moore, M. M. Buffalo, N. Y.

Robert Gunn, For. C. Rep. Buffalo, N. Y.  
Roch. Div.: G. A. Thompson, Supt. Rochester, N. Y.

Frank Tuma, M. M. Rochester, N. Y.  
W'n Div.: H. E. Gilpin, Supt. Hornellsville, N. Y.

C. P. Weiss, M. M. Hornellsville, N. Y.  
Tioga Div.: E. E. Loomis, Supt. Elmira, N. Y.

Bradford Div.: C. V. Merriek, S. Bradford, Pa.  
C. P. Weiss, M. M. Bradford, Pa.

N. Y. & Greenwood L. Ry.  
4-8½ g. 51 m. 1 lo. 23 pass. c. 20 frt. c.

T. H. Pendell, Supt. Jersey City, N. J.  
N. H. R. of N. J. Div.: 4-8½ g. 26 m. 20 p. c.

T. H. Pendell, Supt. Jersey City, N. J.  
N. Y. Pa. & O. Div.

4-8½ g. 599 m. 247 lo. 141 pass. c. 9,442 frt. c.  
J. C. Moorhead, Gen. Supt. Cleveland, O.

W. Lavery, Asst. Supt. M. P. Cleveland, O.  
1st & 2d Div.: I. Beinap, Supt. Meadville, Pa.

George Donahue, M. M. Meadville, Pa.  
3d & 4th Divs.: C. A. Allen, Supt. Gallon, O.

A. W. Ball, M. M. Gallon, O.  
Mahog'Div.: H. N. Donaldson, Supt. Youngstown, O.

Willard Kells, M. M. Cleveland, O.  
Erie & Huron Ry. 4-8½ g. 74 m. 51.54 c.

J. J. Ross, Gen. Man. & P. A. Chatham, Ont.  
F. Stamenlen, M. P. Chatham, Ont.

Erie & Pittsburgh R. R. (See Penna. Co.)  
Erie & Wyoming Valley R. R. 4-8½ g. 78.23 m. 30 lo. 1,386 c.

Geo. E. Smith, Pres. Supt. & P. A. Dunmore, Pa.  
D. E. Barton, M. M. Dunmore, Pa.

S. D. King, M. C. B. Dunmore, Pa.  
Eureka & Palisade R. R. 3 g. 84.5 m. 120 cars.

G. D. Abbott, Gen. Supt. & Pur. Agt. Eureka, Nev.  
Eureka Springs Ry. 4-8½ g. 18½ m. 2 lo. 8 cars

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J. M. Booth, Supt. & P. A. Kissimmee, Fla.  
Florida Central & Peninsular R. R.  
4-9 g. 940.77 m. 11 lo. 2,022 cars.  
D. E. Maxwell, G. M. & Pur. Agt. Jacksonville, Fla.  
E. Burton, M. M. Fernandina, Fla.  
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Florida East Coast Ry. 4-9 1/2 g. 401 m. 27 lo. 157 c.  
J. D. Wright, Pur. Agt. New York, N. Y.  
Geo. A. Miller, M. M. St. Augustine, Fla.  
P. F. Starr, M. C. B. St. Augustine, Fla.  
Florida Southern Ry. (See Plant System).  
Fonda, Johnston & Gloversville R. R.  
4-8 1/2 g. 32 m. 9 lo. 49 c.  
R. T. McKeever, G. S. & Pur. Agt. Gloversville, N. Y.  
Ft. Worth & Denver City Ry.  
4-8 1/2 g. 469 m. 32 l. 1,018 cars.  
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J. V. Goode, G. S. & Pur. Agt. Ft. Worth, Tex.  
Geo. K. Jackson, M. M. Ft. Worth, Tex.  
Fort Worth & Rio Grande Ry. 4-8 1/2 g. 14 m. 9 l. 109 c.  
John Hornby, Pres., G. S. & P. A. Fort Worth, Tex.  
B. G. Plummer, M. M. & M. C. B. Ft. Worth, Tex.  
Frankfort & Cincinnati Ry.  
4-8 1/2 g. 40 m. 4 lo. 34 cars.  
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Frankfort, Ky.  
T. M. Horton, M. M. Frankfort, Ky.  
John Quinley, M. C. B. Frankfort, Ky.  
Franklin & Meranti R. R. 2 g. 25 m. 2 lo. 45 c.  
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P. H. Stubbs, Pur. Agt. Strong, Mass.  
W. S. Heath, M. M. & M. C. B. Salem, Me.  
Fremont, Elkhorn & Mo. Val. R. R. (See St. Louis & Pac.)  
Fulton County N. G. Ry. 3 g. 61 m. 5 lo. 190 cars.  
S. H. Mallory, Pres. & Gen. Man. Charleston, Ia.  
A. C. Atherton, G. S., P. A., M. M. & M. C. B.  
Lewistown, Ill.

## G

Gal., Harrisburg & San Antonio Ry. (See So. Pac.)  
Galveston, La Porte & Houston Ry.  
4-8 1/2 g. 61 m. 7 l. 302 c.  
J. Waldo, Pres. & Gen. Man. Houston, Tex.  
T. W. House, M. T. Jones, Receivers, Houston, Tex.  
H. J. Simmons, G. Supt. & Pur. Agt., Houston, Tex.  
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George's Creek & Cumberland R. R.  
4-9 g. 33 m. 10 lo. 1,108 cars.  
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Cumberland, Md.  
Thos. McCann, M. M. & M. C. B. Cumberland, Md.  
Georgia R. R. 4-9 g. 303 m. 53 lo. 972 cars.  
Thos. K. Scott, G. M. & P. A. Augusta, Ga.  
John S. Cook, M. M. Augusta, Ga.  
E. S. Scheetz, M. C. B. Augusta, Ga.  
Georgia & Alabama Ry.  
4-8 1/2 g. 450 m. 35 lo. 1,310 cars.  
Cecil Gabbett, V. P. G. M. & P. Agt.  
Americus, Ga.  
F. H. McGe, M. M. Americus, Ga.  
J. E. Cameron, M. C. B. Americus, Ga.  
Georgia Midland Ry. (See Southern Ry.)  
Georgia Southern & Florida Ry. Co.  
4-8 1/2 g. 285 m. 29 lo. 967 cars.  
J. Lane, Gen. Supt. & Pur. Agt., Macon, Ga.  
L. B. Rhodes, For. Loco. Rep., Macon, Ga.  
J. E. Capps, For. Car. Rep., Macon, Ga.  
Grafton & Upton R. R. 4-8 1/2 g. 16 1/2 m. 3 lo. 6 c.  
E. P. Usher, Gen. M. & P. A. Grafton, Mass.  
J. H. Hamilton, M. M. Milford, Mass.  
Grand Rapids & Indiana Ry.  
4-9 g. 581 m. 73 lo. 3,229 c.  
J. B. P. Hughart, G. M. Grand Rapids, Mich.  
W. R. Shelby, V. P. & P. A. Grand Rapids, Mich.  
J. E. Keegan, M. M. Grand Rapids, Mich.  
Grand Tower & Carbondale. (See Chicago & Tex.)  
Grand Trunk Ry. 4-8 1/2 g. 3,512 m. 795 lo. 23,486 c.  
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Adolph Butze, Gen. Pur. Agt., Montreal, Can.  
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4-8 1/2 g. 4,482 m. 429 lo. 332 pass. & 14,709 frt. cars.  
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Green Bay & Western R. R.  
4-8 1/2 g. 250 m. 23 lo. 464 cars.  
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M. M. Green Bay, Wis.  
Greenfield & Northern R. R.  
(See Kansas City, Fort Scott & Memphis R. R.)  
Green Pond, Walterboro & Branchville Ry.  
(See Plant System)  
Green Ridge R. R. of Maryland.  
3 g. 26 m. 2 lo. 22 cars.  
F. Mortens, Pres. & P. A. Cumberland Md.  
Greenwich & Johnsonville Ry. 4-8 1/2 g. 13.15 m. 2 lo. 56 c.  
J. H. Thompson, G. M. G. S. & P. A. Greenwich, N. Y.  
Henry Kimball, M. M. Greenwich, N. Y.  
Gulf, Beaumont & Kansas City Ry. Co.  
4-8 1/2 g. 65 m. 5 l. 265 c.  
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W. W. Willson, Asst. Gen. Man. & Pur. Agt., Beaumont, Tex.  
Frank G. Papineau, M. M. & M. C. B., Beaumont, Tex.

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Gulf, Col. & Santa Fe Ry. (See A. T. & S. F. Ry.)  
Gulf, W'n Texas & Pac. Ry. (See Southern Pacific.)

## H

Hannibal & St. Jo. R. R. 4-8 1/2 g. 295 m. 66 lo. 1,328 c.  
(See C., B. & Q. R. R.)  
Housatonic R. R. (See N. Y., N. H. & H. R. R.)  
Houston & Tex. Cen. Ry. 4-8 1/2 g. 510 m. 113 lo. 2,578 c.  
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4-9 g. 63 m. 24 lo. 2,688 c.  
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C. R. Yohn, M. M. Saxton, Pa.  
Hutchinson & Southern Ry. 4-8 1/2 g. 82 m. 2 l. 26 c.  
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W. A. Bradford, Jr., G. M. Hutchinson, Kan.  
John A. S. Graves, Pur. Agt. Hutchinson, Kan.  
Frank Ferrell, M. M. Hutchinson, Kan.  
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## I

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H. McCourt, Supt., Centralia, Ill.  
J. W. Stokes, M. M., E. St. Louis, Ill.  
Amboy Div.: J. W. Higgins, Supt. La Salle, Ill.  
J. H. Bannerman, M. M., Clinton, Ill.  
Springfield Div.:  
D. S. Bailey, Supt., Clinton, Ill.  
J. H. Bannerman, M. M., Clinton, Ill.  
Freeport Div.:  
H. R. Dill, Supt., Freeport, Ill.  
E. O. Dana, M. M., Freeport, Ill.  
Dubuque Div.:  
F. R. Harriman, Supt., Dubuque, Ia.  
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Indiana, Illinois & Iowa R. R.  
4-8 1/2 g. 152 m. 25 l. 245 c.  
T. P. Shonts, Gen. Man. & Pur. Agt. Chicago, Ill.  
Peter Maher, M. M. & M. C. B. Kankakee, Ill.  
Indianapolis & St. Louis R. R. (See C. C. & St. L.)  
Indianapolis & Vincennes R. R. (See Penn. Co.)  
Indiana, Decatur & Western Ry.  
4-8 1/2 g. 153 m. 18 lo. 762 c.  
R. B. F. Pierce, Gen. Man., India. apolis, Ind.  
George R. Balch, Pur. Agt., Cincinnati, O.  
J. W. Connaty, Asst. M. M., Indianapolis Ind.  
Intercolonial Ry. of Canada  
4-8 1/2 g. 1,150 m. 204 lo. 6,842 c.  
David Pottinger, Gen. Man., Moncton, N. B.  
T. V. Cooke, Pur. Agt., Moncton, N. B.  
F. R. F. Brown, Mech. Supt., Moncton, N. B.  
Grant Hall, Gen. Loco. Fore., Moncton, N. B.  
D. White, Gen. Car Foreman, Moncton, N. B.  
International & Great Northern Ry.  
4-8 1/2 g. 825 m. 99 lo. 1,853 cars.  
Leroy Trice, Gen. Supt., Palestine, Tex.  
A. Gould, Pur. Agt., St. Louis, Mo.  
F. Hufsmith, Supt. M. P. & R. S. Palestine, Tex.  
Iowa Central Ry. 4-8 1/2 g. 498 m. 60 lo. 1,853 cars.  
Col. L. M. Martin, G. M., Marshalltown, Ia.  
S. M. Rogers, Pur. Agt., Marshalltown, Ia.  
B. Reiley, M. M., Marshalltown, Ia.  
Iron Ry. 4-8 1/2 g. 20 m. 4 lo. 214 cars.  
C. C. Clarke, Gen. Man., Ironton, O.  
B. S. J. Garvey, Pur. Agt., Ironton, O.  
G. A. Meyers, M. M., Ironton, O.  
B. Martin, M. C. B., Ironton, O.  
Irondale, Bancroft & Ottawa Ry.  
4-8 1/2 g. 45 m. 3 lo. 35 cars.  
Chas. J. Pusey, Gen. Man. & Pur. Agt., Irondale, Ont.  
Jos. Webb, M. M., Irondale, Ont.  
Ironton R. R. 4-8 1/2 g. 12 m. 2 lo.  
W. Andrews, Gen. Man., Allentown, Pa.  
D. W. McPetridge, Pur. Agt., Hokendauqua, Pa.  
S. R. Thomas, M. M., Hokendauqua, Pa.  
& St. Louis Ry.  
4-8 1/2 g. 134 m. 8 lo. 198 cars.  
Sam'l P. Wheeler, Rec., Jacksonville, Ill.  
C. M. Stanton, Gen. Man., Jacksonville, Ill.

Edwin M. Stanton, P. Agt., Jacksonville, Ill.  
John Foulk, M. M. & M. C. B. Jacksonville, Ill.  
Jacksonville, Tampa & Key West Ry.  
4-9 g. 200 m. 26 lo. 528 cars.  
Joseph H. Durkee, Receiver, Jacksonville, Fla.  
W. B. Coffin, G. S. & P. A. Jacksonville, Fla.  
F. E. Tobbs, M. M., Palatka, Fla.  
Jamestown & Lake Erie Ry. Co.  
4-8 1/2 g. 30 m. 4 l. 8 cars.  
O. R. Van Kitten, G. M. & P. A. Jamestown, N. Y.  
F. H. McFail, M. M. & M. C. B., Jamestown, N. Y.  
Jeffersonv., Mad. & Ind. R. R. (P. C. C. & St. L. Ry.)  
K  
Kanawha & Michigan Ry. 4-9 g. 168 m. 15 l. 600 c.  
(See Ohio Central lines.)  
Kansas City, St. Joseph & Council Bluffs.  
4-8 1/2 g. 308 m. 44 lo. 1,038 c.  
(See C., B. & Q. R. R.)  
Kansas City, Osceola & Southern Ry. (Blair Line.)  
4-8 1/2 g. 112 m. 12 lo. 314 c.  
B. S. Josselyn, G. M. & P. A., Clinton, Mo.  
C. A. Burdick, M. M., Clinton, Mo.  
S. F. Gentry, M. C. B., Clinton, Mo.  
Kansas City, Fort Scott & Memphis, Kansas City.  
Clinton & Springfield and Current River Rys.  
4-8 1/2 g. 953 m. 170 l. 7,630 c.  
Edward S. Washburn, Pres. & G. M., Kansas City, Mo.  
H. P. Jacques, Pur. Agt., Kansas City, Mo.  
W. A. Nettleton, Supt. M. P. & M., Kansas City, Mo.  
S. H. Briggs, M. M., Memphis, Tenn.  
Kansas City, Pittsburgh & Gulf R. R.  
4 ft. 8 1/2 in. g. 672 m. 59 lo. 2,239 cars.  
Robert Gillham, Gen. Man., Kansas City, Mo.  
Ira C. Hubbell, Pur. Agt., Kansas City, Mo.  
F. Mertsheimer, Supt. M. P. & E., Kansas City.  
David Patterson, M. M. & M. C. B., Pittsburgh, Kan.  
Kansas City, Shreveport & Gulf Ry.  
(See Kansas City, Pittsburgh & Gulf R. R.)  
Kansas City, Watkins & Gulf Ry.  
4-8 1/2 g. 116 m. 9 lo. 186 cars.  
J. B. Watkins, Pres., Lake Charles, La.  
Thos. Saunders, Gen. Man., Lake Charles, La.  
J. C. Ramsey, M. M., Lake Charles, La.  
Kansas Midland Ry.  
4-8 1/2 g. 105 m. 11 lo. 92 ft. & 2 pass cars.  
A. L. Wolff, Rec., Wichita, Kan.  
W. P. Homan, G. M. & P. A., Wichita, Kan.  
C. A. De Haven, M. M. & M. C. B., Wichita, Kan.  
Kent Northern Ry. 4-8 1/2 g. 45 m. 4 lo. 31 cars.  
W. Brown, Gen. Man., Richbucto, N. B.  
T. Murray, Supt. & M. C. B. Richbucto, N. B.  
Animaux, M. M., Richbucto, N. B.  
Kentucky & Indiana Bridge Co.  
4-8 1/2 g. 15 m. 5 lo. 14 cars.  
John MacLeod, Rec., Louisville, Ky.  
F. W. Tracy, Rec., Springfield, Ill.  
S. M. Felton, Rec., Cincinnati, O.  
K. MacLeod, Pur. Agt., Louisville, Ky.  
J. Newhouse, M. M., Louisville, Ky.  
Kentucky & South Atlantic Ry.  
(See Chesapeake & Ohio Ry. Co.)  
Kentucky Central Ry. (Operated by L. & N. R. R.)  
Keokuk & Western R. R. 4-8 1/2 g. 148 m. 17 l. 955 c.  
A. C. Goodrich, G. M., Keokuk, Ia.  
R. D. Lewis, Pur. Agt., Keokuk, Ia.  
W. Augustus, Supt. Mach., Keokuk, Ia.  
Kickapoo Valley & Northern Ry. Co.  
4-8 1/2 g. 38 m. 2 lo. 21 cars.  
E. A. Wadhams, Rec., Milwaukee, Wis.  
W. H. Thomson, G. M. & P. A., Waukegan, Wis.  
J. W. Chase, M. M., Waukegan, Wis.  
Kings Co. Elevated Ry. 4-8 1/2 g. 8 1/2 m. 44 lo. 145 c.  
W. T. Goudie, Gen. Man., Supt. & Pur. Agt., Brooklyn, N. Y.  
W. T. Thompson, M. M., Brooklyn, N. Y.  
W. S. Sutton, M. C. B., Brooklyn, N. Y.  
Kingston & Pembroke Ry. 4-8 1/2 g. 123 m. 11 lo. 370 c.  
B. W. Folger, Gen. Man., Kingston, Ont.  
F. A. Folger, Jr., G. S. & P. A. Kingston, Ont.  
F. W. Clark, M. M., Kingston, Ont.  
D. Nisbett, M. C. B., Kingston, Ont.  
Knoxville & Augusta R. R. 4-8 1/2 g. 16 m. 2 lo. 28 cars.  
W. P. Hood, Gen. Supt. & P. A. Knoxville, Tenn.  
John L. Bradford, M. M., Knoxville, Tenn.  
W. C. Bruce, M. C. B., Knoxville, Tenn.  
Knoxville, Cumberland Gap & Louisville R. R.  
4-9 g. 81.80 m. 12 lo. 450 cars.  
W. H. Green, Gen. Supt., Washington, D. C.  
W. H. Thomas, Supt. M. P. Washington, D. C.  
H. Clark, M. C. B., Knoxville, Tenn.

## L

Lake Champlain & Moriah Ry.  
4-8 1/2 g. 16 m. 9 lo. 326 cars.  
A. E. Tower, G. M. & P. A. Poughkeepsie, N. Y.  
C. P. Morrison, M. M., Port Henry, N. Y.  
R. C. Smith, M. C. B., Port Henry, N. Y.  
Lake Erie, Alliance & So'n Ry.  
(See Alliance & Northern R. R.)  
Lake Erie & Detroit River Ry.  
4-8 1/2 g. 108 m. 8 lo. 218 c.  
E. C. Walker, Gen. Man., Dir., Walkerville, Ont.  
Alex. Leslie, Pur. Agt., Walkerville, Ont.  
S. Austin, Mech. Supt., Walkerville, Ont.  
Lake Erie & West'n R. R. & Ft. Wayne, Cin. & Louisville Ry. 4-8 1/2 g. 725 m. 115 lo. 5,323 c.  
Geo. L. Bradbury, V. P. & G. M., Indianapolis, Ind.  
T. H. Perry, Pur. Agt., Indianapolis, Ind.  
P. Reilly, Supt. Equipment, Lima, O.  
Lake Shore & Michigan So'n Ry.  
4-8 1/2 g. 1,440 m. 51 lo. 20,415 cars.  
S. R. Callaway, Pres., Cleveland, O.

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Gilmore, <i>M. M.</i> .....Elkhart, Ind. T. Filides, <i>M. C. B.</i> .....Englewood, Ill. Lakeside & Marblehead R.R. Co. 4-84g. 10m. 21.11c. C. E. Gowen, <i>G. M. &amp; P. A.</i> .....Cleveland, O. W. M. Haran, <i>G. S.</i> .....Cleveland, O. Lancaster, Oxford & Southern R.R. 3g. 20m. 21.24c. A. M. Nevin, <i>Gen. Man.</i> & P. A. Oxford, Pa. Lebanon Springs R. R. 4-84g. 58 m. 4 lo. 18 cars. E. Sweet, <i>Rec.</i> .....Bennington, Vt. K. D. Bennett, <i>Supt. &amp; Pur. Agt.</i> Bennington, Vt. Lehigh & Hudson River R.R. 4-84g. 90m. 22lo. 753 c. Grinnell Burt, <i>Gen. Man.</i> .....Warwick, N. Y. E. M. Reynolds, <i>Pur. Agt.</i> .....Warwick, N. Y. Lehigh & Lackawanna R.R. See Cent. R.R. of N. Y.) Lehigh & New England R. R. 4-84g. 77 m. 3 lo. 23 cars. Wm. J. Turner, <i>G. S.</i> .....Philadelphia, Pa. Wm. J. Young, <i>G. S.</i> & P. Agt. & M. M. Lehigh Valley R. R. 4-84g. 1,182m. 744 lo. 56,965c. R. H. Wilbur, <i>Gen. Supt.</i> So. Bethlehem, Pa. Samuel Higgins, <i>Supt. M. P. So.</i> Bethlehem, Pa. John S. Lentz, <i>Asst. Supt. M. P.</i> So. Bethlehem, Pa. John I. Kinsey, <i>Supt. Machy.</i> .....Easton, Pa. W. C. Alderson, <i>Pur. Agt.</i> Philadelphia, Pa. Philip Wallis, <i>M. M.</i> .....So. Easton, Pa. Fred. Roth, <i>M. M.</i> .....Delano, Pa. H. D. Taylor, <i>M. M.</i> .....Wilkes-Barre, Pa. J. N. Weaver, <i>M. M.</i> .....Sayre, Pa. John Campbell, <i>M. M. &amp; M. C. B.</i> Buffalo, N. Y. Geo. F. Richards, <i>Asst. M. M. Cortland, N. Y.</i> Lexington & Eastern Ry. Co. 4-9 g. 94 m. 8 lo. 373 cars. J. R. Barr, <i>Gen. Man.</i> .....Lexington, Ky. Pur. Agt. Lexington, Ky. E. R. McCuen, <i>Gen. For.</i> .....Lexington, Ky. Ligonier Valley R. R. 4-9 g. 11 m. 31 lo. 19 cars. Thos. A. Mellon, <i>Gen. Man.</i> .....Ligonier, Pa. Geo. Seft, <i>S. P. A. &amp; M. C. B.</i> .....Ligonier, Pa. Sam'l L. French, <i>M. M.</i> .....Ligonier, Pa. Little Miami Ry. (See P. C. & S. L.) Little Rock & Fort Smith. (See Mo. Pac.) Lit. Ro. k & Memphis R. R. 4-84g. 135m. 16lo. 300c. R. Fink, <i>G. M. &amp; P. A.</i> .....Little Rock, Ark. C. Robben, <i>M. M.</i> .....Argenta, Ark. A. Waldo, <i>M. C. B.</i> .....Argenta, Ark. Little Saw Mill Run R. R. 4-84g. 3 m. 3 lo. 178c. C. Schoeneman, <i>G. S. &amp; Pur. A.</i> Pittsburgh, Pa. Jas. Easton, <i>M. C. B.</i> .....Banksville, Pa. Litchfield, Carrollton & Western Ry. Co. 4-84g. 57.8 m. 31 lo. 36 cars. Jos. Dickson, <i>Receiver.</i> .....St. Louis, Mo. T. W. Geor, <i>Gen. Supt.</i> .....Carrollton, Ill. H. L. Greer, <i>M. M.</i> .....Carrollton, Ill. Live Oak & Gulf Ry. 4-8g. 20 m. 1 lo., 3 cars. Chas. W. White, <i>V. P. G. M. &amp; P. A.</i> Citra, Fla. Long Island R. R. 4-84g. 378.89 m. 148 lo. 1,725 c. Wm. H. Baldwin, Jr., <i>Pres.</i> Long Island City, N. Y. H. B. Hodges, <i>Pur. Agt.</i> Long Island City, N. Y. S. F. Prince, Jr., <i>S. M. P. &amp; E.</i> Morris Park, N. Y. Los Angeles Terminal Ry. 4-84g. 51 m. 8 lo. 196 cars. S. B. Hynes, <i>G. M. &amp; P. A.</i> Los Angeles, Cal. T. R. Shanks, <i>M. M. &amp; M. O. B.</i> Los Angeles, Cal. Louisiana Southern Ry. Co. 4-9g. 46 m. 5 lo. 54 cars. P. Campbell, <i>Gen. Man. &amp; Pur. Agt.</i> New Orleans, La. J. T. Brumbach, <i>M. M. &amp; M. C. B.</i> New Orleans, La. Louisville & Nashville R. R. 4-9 g. 3,171 m. 544 lo. 20,751 cars. J. G. Metcalfe, <i>Gen. Man.</i> .....Louisville, Ky. P. P. Huston, <i>Pur. Agt.</i> .....Louisville, Ky. P. Leeds, <i>Supt. Mach.</i> .....Louisville, Ky. A. Beckert, <i>Gen. M. M.</i> .....New Decatur, Ala. Kent. Con. Div.: L. Hood, <i>Supt.</i> .....Cincinnati, O. Wm. Adair, <i>M. M.</i> .....Covington, Ky. Louisv. Cin. & Lex. Div.: C. A. Davin, <i>Supt.</i> .....E. Louisville, Ky. Wm. Adair, <i>M. M.</i> .....Covington, Ky. Lou. Div.: W. S. Martin, <i>Supt.</i> .....Louisville, Ky. J. G. Clifford, <i>M. M.</i> .....Louisville, Ky. Nash. Div.: J. Geddes, <i>Supt.</i> .....Nashville, Tenn. R. Moran, <i>M. M.</i> .....Bowling Green, Ky. Alabama Mineral Div.: W. E. Knox, <i>Supt.</i> .....Anniston, Ala. J. H. Watters, <i>M. M.</i> .....Anniston, Ala. Mob. & M.: Div. Pens. & Sel. R. Ra.: J. I. McKinney, <i>Supt.</i> .....Montgomery, Ala. H. Minto, <i>M. M.</i> .....Mobile, Ala. Pensacola Div.: K. O. Saltmarsh, <i>Supt.</i> .....Pensacola, Fla. C. F. Giles, <i>M. M.</i> .....Pensacola, Fla. Memp. Line Div.: L. S. Robertson, <i>S. Memphis, Tenn.</i> J. V. Slusser, <i>M. M.</i> .....Memphis, Tenn. St. L. & Hend. Div.: B. F. Dickson, <i>Supt.</i> .....Evansville, Ind. Thos. Walsh, <i>M. M.</i> .....Howell, Ind. O. & N. Div.: S. Dunn, <i>Supt.</i> Russellville, Ky. Louisville, Evansville & St. L. Consolidated R. R. 4 ft. 9 in. g. 374.65 m. 53 lo. 2,448 cars. G. T. Jarvis, <i>G. M. &amp; Rec.</i> .....Louisville, Ky.	W. W. Wents, Jr., <i>Pur. Agt.</i> Louisville, Ky. F. O. Cleaver, <i>M. M.</i> .....Princeton, Ind. Louisville, New Albany & Corydon. 4-84g. 11 m. 21.3 cars. M. J. O'Connor, <i>Gen. Man.</i> .....Corydon, Ind. G. W. Briffett, <i>P. A. &amp; M. M.</i> .....Corydon, Ind. Louisville, New Albany & Chicago Ry. (See Chicago, Indianapolis & Louisville Ry.) Louisville, New Orleans & Tex. Ry. (See Ill. Central) Louisville, Henderson & St. Louis Ry. 4-9 g. 186 m. 18 lo. 768 cars. Attila Cox, <i>Rec.</i> .....Louisville, Ky. A. M. McCracken, <i>Gen. Supt.</i> .....Louisville, Ky. C. P. Bush, <i>Pur. Agt.</i> .....Louisville, Ky. M. M. ....Cloverport, Ky. M Macon & Birmingham Ry. 4-84g. 97m. 5lo. 193c. Julian R. Lane, <i>Gen. Man.</i> .....Macon, Ga. Macon & Northern Ry. Co. 4-9 g. 107m. 6 lo. 87 c. Edgar A. Ross, <i>Receiver.</i> .....Macon, Ga. A. H. Porter, <i>Supt.</i> .....Macon, Ga. W. A. Carey, <i>Fore. Car Dept.</i> .....Macon, Ga. Macon, Dublin & Savannah. 4-84g. 54 m. 2 lo. 47 cars. J. T. Wright, <i>Gen. Man.</i> .....Macon, Ga. P. Hough, <i>Pur. Agt.</i> .....Macon, Ga. D. B. Dunn, <i>G. S.</i> & M. M. & M. C. B. Macon, Ga. Maine Central R. R. 4-84g. 821m. 157 lo. 4,217 c. Geo. F. Evans, <i>Gen. Man.</i> .....Portland, Me. A. S. Bosworth, <i>Pur. Agt.</i> .....Portland, Me. Amos Pillsbury, <i>Supt. M. P.</i> .....Portland, Me. John Ellis, <i>M. M.</i> .....Waterville, Me. C. H. Kenison, <i>M. C. B.</i> .....Portland, Me. Manhattan Ry. 4-84g. 36 m. 381 lo. 1,117 c. Wm. J. Franchioli, <i>G. M. &amp; P. A.</i> New York, N. Y. M. McNally, <i>M. M.</i> .....New York, N. Y. H. A. Webster, <i>M. C. B.</i> .....New York, N. Y. Manistee & Luther Ry. 3 g. 60 m. 6 lo. 240 cars. R. G. Peters, <i>Gen. Man.</i> .....Eastlake, Mich. H. W. Carey, <i>Pur. Agt.</i> .....Eastlake, Mich. T. J. Peach, <i>M. M. &amp; M. C. B.</i> Eastlake, Mich. Manistee & North East'n R.R. 4-84g. 90m. 7lo. 293c. Edward Buckley, <i>Gen. Man.</i> .....Manistee, Mich. J. M. Peterson, <i>Pur. Agt.</i> .....Manistee, Mich. Wm. H. Nuttall, <i>S. M. P. &amp; R. S.</i> Manistee, Mich. E. N. Veist, <i>M. C. B.</i> .....Manistee, Mich. Maricopa, Phoenix & Salt River Valley R. R. 4-84g. 45 m. 31 lo. 65c. C. O. McNell, <i>Gen. Supt.</i> .....Phoenix, Ariz. F. I. Kendall, <i>Pur. Agt.</i> .....San Francisco, Cal. Marietta & North Georgia R. R. (See Atlanta, Knoxville & Northern Ry.) Mason & Oceana Ry. 3 g. 27 m. 7 lo. 225 cars. M. McDermott, <i>Gen. Supt.</i> .....Ludington, Mich. O. Wrege, <i>M. M.</i> .....Ludington, Mich. J. Johnson, <i>M. C. B.</i> .....Ludington, Mich. Mason City & Ft. Dodge R. R. 4-84g. 92 m. 61. 207c. O. B. Grant, <i>Supt. &amp; Pur. A.</i> Fort Dodge, Ia. E. H. Maute, <i>M. M. &amp; M. C. B.</i> Fort Dodge, Ia. Maassillon & Cleve. Ry. (See Penna. Co.) Meadville & Linesville Ry. (See Pitts. Shen. & Erie Ry.) Memphis & Charleston R. R. 4-9 g. 330m. 39 1.1,049c. R. B. Pegram, <i>Gen. Supt.</i> .....Memphis, Tenn. J. P. Minetree, <i>Pur. Agt.</i> Washington, D. C. J. H. Buckalew, <i>M. M.</i> .....Memphis, Tenn. R. T. Hayes, <i>M. C. B.</i> .....Memphis, Tenn. Mexican Ry. 4-84g. 331 m. 63 lo. 770 cars. Geo. Foote, <i>Gen. Man.</i> .....Mexico, Mex. Alfred Attwood, <i>Loco. Supt.</i> Apizaco, Mex. Mexican Central Ry. Co., Limited. 4-84g. 1,955 m. 166 lo. 3,053 cars. H. R. Nickerson, <i>Gen. Man.</i> .....City of Mexico. F. P. McIntyre, <i>Pur. Agt.</i> .....Boston, Mass. F. W. Johnstone, <i>Supt. M. P. &amp; M.</i> City of Mexico. J. H. O'Brien, <i>M. C. B.</i> .....City of Mexico. P. O. Address of all Officers in Mexico is El Paso, Texas. Mexican International R. R. Co. 4-84g. 659 m. 40 lo. 1,488 cars. L. M. Johnson, <i>Gen. Man.</i> Ciudad Porfirio Diaz, Mex. W. Hollis, <i>Mat. Agt.</i> Ciudad Porfirio Diaz, Mex. W. Jennings, <i>Supt. Mech. Dept.</i> Ciudad Porfirio Diaz, Mex. Mexican National R. R. 3 g. 1,218 m. 123 lo. 2,538 c. E. N. Brown, <i>Gen. Man.</i> .....City of Mexico. A. Anderson, Jr., <i>Pur. Agt.</i> New York, N. Y. Thos. Milan, <i>S. M. P. &amp; Mach.</i> Laredo, Tex. Northern Division: J. N. Galbraith, <i>Supt.</i> .....Laredo, Tex. J. Farrell, <i>M. M.</i> .....Laredo, Tex. San Luis Potosi Div.: A. Clarke, <i>Supt.</i> .....San Luis Potosi, Mex. J. W. Hall, <i>M. M.</i> .....San Luis Potosi, Mex. Southern Div.: V. R. Dwinell, <i>Supt.</i> .....City of Mexico, Mex. W. F. Galbraith, <i>M. M.</i> City of Mexico, Mex. Mexican Southern Ry. 3 g. 223 m. 17 lo. 312 c. W. Morcom, <i>Gen. Man.</i> .....Puebla, Mex. H. E. Walker, <i>M. M.</i> .....Puebla, Mex. Michoacan & Pacific Ry. 3 g. 60 m. 5 lo. 81 cars. L. R. Gordon, <i>G. S. &amp; P. A.</i> Zitacuaro, Michoacan, Mex. W. H. Rice, <i>M. M.</i> Zitacuaro, Michoacan, Mex. Michigan Cen. R. R. 4-84g. 1,025.37m. 461 lo. 13,587 c. H. B. Ledyard, <i>Pres. &amp; Gen. Man.</i> Detroit, Mich. R. H. L'Hommedieu, <i>Gen. Supt.</i> Detroit, Mich. J. R. Dutton, <i>Pur. Agt.</i> .....Detroit, Mich. Robt. Miller, <i>Supt. M. P. &amp; E.</i> Detroit, Mich. E. D. Branner, <i>Asst. Supt. M. P. &amp; E.</i> West Detroit, Mich. (1) Lines West of Detroit River: East. Toledo & Bay City Div.: D. S. Sutherland, <i>Supt.</i> .....Detroit, Mich. P. Miller, <i>M. M.</i> .....Detroit, Mich. Sag. & Mack Div.: W. J. Martin, <i>Supt.</i> .....Bay City, Mich. M. Ryan, <i>M. M.</i> .....Bay City, Mich.	Mid. Air Line: Gr. Rap. and So. Hav. Div.: O. F. Jordan, <i>Supt.</i> .....Jackson, Mich. T. J. Hennessey, <i>Div. M. M.</i> Jackson, Mich. West & Joliet Div.: J. H. Snyder, <i>Supt.</i> .....Chicago, Ill. J. G. Riley, <i>M. M.</i> .....Chicago, Ill. (2) Lines East of Detroit River: Canada & Mich. Mid. Div.: J. B. McFarford, <i>Supt.</i> .....St. Thomas, Ont. M. L. Flynn, <i>M. M.</i> .....St. Thomas, Ont. R. Potts, <i>Gen. F. C. Dept.</i> St. Thomas, Ont. Middle Georgia & Atlantic Ry. (See Central of Georgia Ry. Co.) Millen & Southern. 4-84g. 32 m. 4 lo. 13 cars. J. F. Gray, <i>Supt. &amp; P. A.</i> .....Millen, Ga. F. W. Reavey, <i>M. M.</i> .....Millen, Ga. Mineral Range and Hancock & Calumet R. Ra. 3 g. 48 m. 16 lo. 168 cars. W. F. Fitch, <i>Gen. Man.</i> .....Marquette, Mich. J. C. Shields, <i>Supt.</i> .....Hancock, Mich. P. W. Brown, <i>P. A.</i> .....Marquette, Mich. J. J. Conolly, <i>M. M.</i> .....Marquette, Mich. Midland No. Car Ry. (See At. Coast Line.) Milwaukee & Northern R.R. (See C. M. & St. P. Ry. Co.) Milwaukee, Lake Shore & Western Ry. Co. (See Chicago & Northwestern.) Minneapolis & St. Louis R. R. Co. 4-84g. 608.15 m. 72 lo. 2,444 cars. L. F. Day, <i>Gen. Man.</i> .....Minneapolis, Minn. T. E. Clarke, <i>Gen. Supt.</i> .....Minneapolis, Minn. S. M. Lohren, <i>Pur. Agt.</i> .....Minneapolis, Minn. J. Tongue, <i>M. C. B. &amp; M. M.</i> Minneapolis, Minn. Minneapolis, St. Paul & Sault Ste. Marie Ry. 4-84g. 1,160 m. 103 lo. 6,051 cars. F. D. Underwood, <i>Gen. Man.</i> Minneapolis, Minn. T. A. Switz, <i>Pur. Agt.</i> .....Minneapolis, Minn. E. A. Williams, <i>Mech. Supt.</i> Minneapolis, Minn. Mississippi River & Bonne Terre Ry. 4-84g. 51 m. 7 lo. 230 cars. J. Burns, <i>Supt.</i> .....Bonne Terre, Mo. G. Sets, <i>P. A.</i> .....Bonne Terre, Mo. J. F. Kehrmann, <i>M. M. &amp; M. C. B.</i> Bonne Terre, Mo. Mississippi R. & No. West Ry. 4-84g. 12m. 2 lo. 35c. A. Kimball, <i>G. M. &amp; Supt.</i> Arkansas City, Ark. O. A. Lacy, <i>P. A.</i> .....Arkansas City, Ark. E. Kroger, <i>M. M.</i> .....Arkansas City, Ark. Missouri, Kansas & Texas Ry. Co. 4-84g. 2,198.3 m. 289 lo. 177 pass. c. 8,590 c. A. A. Allen, <i>P. P. &amp; Gen. Man.</i> St. Louis, Mo. C. N. Stevens, <i>Pur. Agt.</i> .....St. Louis, Mo. Wm. O'Heru, <i>Supt. M. M. &amp; E.</i> Parsons, Kan. C. T. McElvany, <i>M. M.</i> .....Denison, Tex. W. H. Brehm, <i>M. M.</i> .....Parsons, Kan. J. Doyle, <i>M. C. B.</i> .....Denison, Tex. John L. Wigton, <i>M. C. B.</i> .....Sedalia, Mo. Missouri Pacific Ry. System, including Missouri Pac. Ry., St. Louis, Iron Mountain and Southern Ry. and leased, operated and independent lines. 4-84g. 5,328.05 m. 651 lo. 22,912 cars. Wm. B. Doddridge, <i>Gen. Man.</i> St. Louis, Mo. F. Rearden, <i>Supt. Loco. &amp; Car Depts.</i> St. Louis, Mo. A. Gould, <i>Pur. Agt.</i> .....St. Louis, Mo. M. B. Schaffer, <i>Gen. F. C. D.</i> St. Louis, Mo. Missouri Pacific Ry. System. 4-84g. 4,938.02 m. 616 lo. 22,083 c. W. B. Doddridge, <i>Gen. Man.</i> St. Louis, Mo. A. Gould, <i>Pur. Agt.</i> .....St. Louis, Mo. H. G. Clark, <i>Gen. Supt.</i> .....St. Louis, Mo. L. Bartlett, <i>Div. M. M.</i> .....St. Louis, Mo. J. P. Weller, <i>Asst. M. M.</i> .....Sedalia, Mo. W. T. New, <i>Asst. M. M.</i> .....Kansas City, Kan. W. J. Hill, <i>Asst. M. M.</i> .....Oswatimie, Kan. J. T. Jones, <i>Asst. M. M.</i> .....Ft. Scott, Kan. Central Branch Union Pac. Ry. 4-84g. 479.44 m. 35 lo. 522ft. cars, 23 pass. cars. H. G. Clark, <i>Gen. Supt.</i> .....St. Louis, Mo. C. W. Weller, <i>Div. M. M.</i> .....Atchison, Kan. St. Louis, Iron Mountain & Southern Ry. 4-84g. 1,773.47m. 283lo. 9,364 ft. cars, 131 pass. c. E. A. Peck, <i>Gen. Supt.</i> .....St. Louis, Mo. W. H. Harris, <i>M. M.</i> .....Do Soto, Mo. Mord. Roberts, <i>M. M.</i> .....Baring Cross, Ark. Mobile & Birmingham R. R. Co. 4-9 g. 163 m. 12 lo. 301 cars. T. G. Bush, <i>Pres. &amp; Gen. Man.</i> Anniston, Ala. J. D. Clark, <i>Supt. &amp; Pur. Agt.</i> Mobile, Ala. J. J. Thomas, Jr., <i>M. M.</i> .....Mobile, Ala. Mobile & Ohio R. R. 4-84g. 687 m. 117 lo. 4,123 c. John G. Mann, <i>Gen. Man.</i> .....St. Louis, Mo. R. H. Duesberry, <i>Pur. Agt.</i> .....St. Louis, Mo. M. T. Carson, <i>Supt. Machy.</i> .....St. Louis, Mo. J. D. Gurganus, <i>M. C. B.</i> .....Whistler, Ala. St. L. Div.: H. W. Clarke, <i>Supt.</i> E. St. Louis, Ill. A. B. Minton, <i>M. M.</i> .....Murphysboro, Ill. G. Manuel, <i>M. M.</i> .....Jackson, Tenn. D. O. Smith, <i>M. M.</i> .....Whistler, Ala. Mohawk & Malone Ry. (See N. Y. C. & H. R. R. R.) Moncton & Buctouche Ry. 4-84g. 32 m. 11. 31 c. E. G. Evans, <i>Gen. Man.</i> .....Moncton, N. B. W. P. Landry, <i>M. M.</i> .....Moncton, N. B. Monongahela River R. R. Co. 4-84g. 33m. 81. 1,335c. J. A. Fickinger, <i>G. M. &amp; P. A.</i> Monongah. W. Va. H. G. Bowles, <i>G. S. &amp; P. A.</i> Monongah. W. Va. J. B. Dorsey, <i>M. M. &amp; M. C. B.</i> Watson, W. Va. Monson R. R. 2 g. 6.16 m. 2 lo. 16c. J. F. Kimball, <i>Gen. Man.</i> .....Wilton, N. H. W. L. Estabrooke, <i>Pur. Agt.</i> .....Monson, Me. H. E. Morrill, <i>M. M. &amp; M. C. B.</i> Monson, Me. Montana Central Ry. 4-84g. 253 m. 21 lo. 835 c. (See Great Northern.) Montana Union Ry. Co. 4-84g. 72m. 29 lo. 360 c. Wm. H. Burns, <i>Gen. Man. &amp; P. A.</i> Butte Mont. G. Lindoff, <i>M. M. &amp; M. C. B.</i> Anaconda, Mont. Monterey & Mex. Gulf R. R. 4-84g. 388 m. 27 lo. 600c. J. H. Mathey, <i>G. M. &amp; P. A.</i> Monterey, Mex. E. Des Essarts, <i>Pur. Agt.</i> .....Monterey, Mex. E. Draguet, <i>M. M.</i> .....Monterey, Mex. Montour R. R. 4-84g. 12 m. 2 lo. 260 cars. U. A. Andrews, <i>Gen. Man. &amp; P. A.</i> Pittsburg, Pa. L. S. Young, <i>Supt.</i> .....Imperial, Pa. Jas. Nelson, <i>M. M. &amp; M. C. B.</i> Imperial, Pa.
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W. A. Stowell, Gen. Man. Montpelier, Vt.  
F. W. Morse, Pur. Agt. Montpelier, Vt.  
G. Jacobson, M. M. Montpelier, Vt.  
C. F. Robinson, M. C. B. Montpelier, Vt.  
Morgan's Louis. & Tex. R.R. (See Southern Pacific.)  
Mount Washington R.R. 4-7 1/2 g. 3 1/2 m. 8 lo. 9 cars.  
T. A. Mackinnon, Gen. Man. Boston, Mass.  
J. A. Farrington, Pur. Agt. Boston, Mass.  
John Horne, Supt. Base Mt. Washington, N.H.

N

Narragansett Pier R. R. 4-8 1/2 g. 8 1/2 m. 2 lo. 16  
G. T. Lanphear, Supt. & Pur. Agt. Peacedale, R.  
E. Gardner, M. M. Peace Dale, R.

Nashville, Chattanooga & St. Louis Ry.  
4-9 g. 905.62 m. 165 lo. 4,661 cars.  
J. W. Thomas, Pres. & G. M. Nashville, Tenn.  
J. W. Thomas, Jr., Pur. Agt. Nashville, Tenn.  
James Cullen, Supt. M. P. Nashville, Tenn.

Natchitoches & Red River Valley Ry. Co.  
4-8 1/2 g. 16 m. 2 lo. 11 cars.  
L. Caspari, G. Man. & P. A. Natchitoches, La.  
A. W. Haslett, M. M. Natchitoches, La.

Nelson & Fort Sheppard Ry.  
(See Spokane Falls & Northern Ry. Co.)

Nevada, California, Oregon Ry. 3 g. 40 m. 4 lo 50 c.  
E. Gest, Gen. Man., P. A. & M. M. Reno, Nev.  
Nevada Central R. R. Co. 3 g. 93 m. 3 lo. 52 c.  
W. I. Phillips, Gen. Man. & P. A. Austin, Nev.  
J. C. Slater, M. M. & M. C. B.

Nevada County N. G. R. R. 3 g. 23 m. 3 lo. 58 cars.  
John F. Kidder, G. Man. & P. A. Grass Valley, Cal.  
Jas. McCormick, M. M. & C. B. Grass Valley, Cal.  
New Brunswick & Prince Edward Island Ry.

4-8 1/2 g. 36 m. 3 lo. 37 cars.  
Josiah Wood, Gen. Man. Sackville, N. B.  
F. C. Harris, Supt. P. A. & M. M. Sackville, N. B.  
Newburg, Dutchess & Conn. R. R.

4-8 1/2 g. 58 miles. 8 l. 182 c.  
G. Hunter Brown, Jr., V. P. & Gen. Man.,  
Matteawan, N. Y.  
Gilman D. Holmes, M. M. & C. B.,  
Dutchess Junction, N. Y.

New England R. R. Co.  
4-8 1/2 g. 558.69 m. 217 lo. 4,769 cars.  
C. Peter Clark, Gen. Man. Boston, Mass.  
Edward Mahler, Pur. Agt. Boston, Mass.  
Thos. Kearsley, G. M. M. Norwood, Mass.  
T. W. Adams, M. C. B. Norwood, Mass.

New Jersey & New York Ry.  
4-8 1/2 g. 45 m. 11 lo. 116 c.  
J. D. Hasbrouck, Gen. Man. & P. A.,  
Jersey City, N. J.

Thos. B. Russum, M. M. Hillsdale, N. J.  
L. B. Van Wagner, M. C. B. Hillsdale, N. J.  
New London Northern R. R.  
(See Central Ver.)

New Mexico & Arizona (See A. T. & Santa Fe R. R.)  
New Orleans, Fort Jackson & Grand Isle R. R.  
4-8 1/2 g. 61 m. 5 lo. 59 cars.

J. S. Landry, Supt. & P. A. Algiers, La.  
E. W. Burgin, M. M. & M. C. B. Algiers, La.  
New Orleans & Northwestern Ry. Co.

4-8 1/2 g. 102 m. 7 lo. 94 cars.  
L. K. Hyde, Rec. & G. M. Titusville, Pa.  
C. G. Vaughn, Pur. Agt. Natchez, Miss.

Newport News & Miss. Val. Co. (See Ch. & O. S. W.)  
4-9 g. 413 m. 92 lo. 3,659 cars.

Newport & Sherman's Valley R. R.  
4 g. 30.67 m. 4 lo. 65 cars.  
D. Gring, Gen. Man. Newport, Pa.

C. K. Miller, Pur. Agt. Newport, Pa.  
W. H. Gring, M. M. Newport, Pa.  
N. Y. & Greenwood Lake Ry. (See N. Y., L. E. & W.)

New York & Northern. 4-8 1/2 g. 61 m. 21 lo. 345 c.  
(See N. Y. Central)

N. Y. Central & Hudson River R.R.  
4-8 1/2 g. 969 m. 843 lo. 32,974 c.

J. M. Toucey, Gen. Man. New York, N. Y.  
A. Bourn, Pur. Agt. New York, N. Y.  
Wm. Buchanan, Supt. M. P. & R. S.,  
New York, N. Y.

S. A. Croone, Asst. Supt. R. S. New York, N. Y.  
G. H. Hazelton, Asst. Supt. M. P. Depew, N. Y.

Mohawk Div.:  
J. R. Leonard, Supt. Albany, N. Y.  
Geo. Van Tassel, M. M. New York, N. Y.

Jas. Buchanan, M. M. Albany, N. Y.  
F. W. Chaffee, M. C. B. Albany, N. Y.  
W'n Div.: J. P. Bradfield, Supt. Buffalo, N. Y.

S. L. White, M. M. Syracuse, N. Y.  
Amos Gould, M. M. Buffalo, N. Y.  
J. Macbeth, M. C. B. Buffalo, N. Y.

N. Y. Chic. & St. L. R.R. 4-8 1/2 g. 523 m. 161 lo. 7,327 c.  
A. W. Johnston, Gen. Supt. Cleveland, O.

M. M. Rodgers, Pur. Agt. Cleveland, O.  
John Mackenzie, Supt. M. P. Cleveland, O.

East'n Div.: W. L. Blair, Supt. Conneaut, O.  
E. A. Miller, M. M. Conneaut, O.

West'n Div.: C. D. Gorham, Supt. Ft. Wayne, Ind.  
Geo. James, M. M. Chicago, Ill.

New York, New Haven & Hartford R. R.  
4-8 1/2 g. 1,464.21 m. 711 lo. 14,171 cars.

C. H. Platt, Gen. Supt. New Haven, Conn.  
R. A. Bishop, Pur. Agt. New Haven, Conn.

F. B. Smith, M. M. New Haven, Conn.  
W. P. Appleyard, M. C. B. New Haven, Conn.

Lewis Wyler, M. M. Hartford, Conn.  
J. W. Leary, M. M. New Haven, Conn.

J. T. Brady, M. M. Harlem River, N. Y.  
Old Colony System:  
J. Henney, Jr., Supt. M. P. New Haven, Conn.

E. G. Allen, Gen. Supt. Boston, Mass.  
R. W. Husted, Pur. Agt. Boston, Mass.  
F. N. Twombly, M. M. Boston, Mass.

S. P. Willis, M. M. Boston, Mass.  
A. W. Twombly, M. M. Taunton, Mass.

L. M. Butler, M. M. Valley Falls, R. I.  
N. Y. Ontario & West. Ry. 4-8 1/2 g. 477 m. 193 lo. 6,522 c.

J. E. Childs, Gen. Man. New York, N. Y.

Chas. A. Draper, *Pur. Agt.* New York, N. Y.  
Geo. W. West, *Supt. M. P.* Middletown, N. Y.  
New York, Pennsylvania & Ohio R. R. (See Erie R. R.)  
4-8 1/2 g. 112 m. 18 lo. 615 c.  
W. A. Patton, *P. & P. A.* Philadelphia, Pa.  
G. W. Russell, *M. M. & C. B.* Cape Charles, Va.  
New York, Providence & Boston R. R. See N. Y.,  
N. H. & B. R. R.  
N. Y., Susquehanna & W. N. R. R.  
4-9 g. 157.75 m. 72 lo. 3,565 c.  
Chas. D. McKelvey, *Gen. Supt.* Jersey City, N. J.  
C. T. Demarest, *Pur. Agt.* Jersey City, N. J.  
W. C. Ennis, *M. M. & C. B.* North Paterson, N. J.  
Norfolk, Virginia Beach & Southern R. R.  
4-8 1/2 g. 18 m. 4 lo. 50 c.  
B. P. Holland, *Gen. Supt. & P. A.* Norfolk, Va.  
M. M. .... Norfolk, Va.  
F. O. Clibourne, *M. C. B.* Norfolk, Va.  
Norfolk & Western Ry. Co.  
4-9 g. 1,570 m. 421 lo. 16,925 cars.  
Henry Fink, *Pres.* Roanoke, Va.  
J. M. Barr, *Vice-Pres. & G. M.* Roanoke, Va.  
K. T. Burnett, *Pur. Agt.* Roanoke, Va.  
L. P. Ligon, *M. M.* Bluefield, W. Va.  
S. K. Dickerson, *M. M.* East Radford, Va.  
W. H. Lewis, *Supt. M. P. & C. B.* Roanoke, Va.  
R. P. C. Sanderson, *M. M.* Roanoke, Va.  
N. W. Noraworthy, *M. M.* .....  
Norfolk & Southern R. R. 4-8 1/2 g. 104 m. 14 lo. 308 c.  
M. K. King, *Gen. Man. & Pur. Agt.* Norfolk, Va.  
G. R. Joughins, *M. M. & C. B.* Berkley, Va.  
North-Eastern R. R. (S. C.)  
Northern New York R. R. 4-8 1/2 g. 56 m. 6 lo. 511 c.  
C. B. Hibbard, *Pres. & G. M.* Moira, N. Y.  
E. Lalime, *Supt. & Pur. Agt. & M. M. & C. B.*  
Santa Clara, N. Y.  
Northern Alabama Ry. Co.  
4-9 g. 120 m. 11 lo. 503 cars.  
Sam'l Hunt, *G. M.* Cincinnati, O.  
F. D. Rhodes, *Pur. A.* .....  
J. T. Brumbach, *M. M. & C. B.* Cincinnati, O.  
Northern California R. R. (See So. Pac. Co.)  
Northern Central Ry.  
Northern Ohio Ry. 4-8 1/2 g. 165 m. 16 lo. 308 cars.  
Geo. L. Bradbury, *Gen. Man.* Indianapolis, Ind.  
T. H. Perry, *Pur. Agt.* Indianapolis, Ind.  
David Anderson, *M. M.* Delphos, O.  
P. Reilly, *Supt. Equipment* Lima, Ohio.  
North Pacific Ry. 4-8 1/2 g. 1,367 634 m. 18,468 c.  
J. W. Kendrick, *Gen. Man.* St. Paul, Minn.  
F. G. Prest, *Pur. Agt.* St. Paul, Minn.  
E. M. Herr, *Supt. M. P. & R. S.* St. Paul, Minn.  
Minn. Div.:  
A. E. Law, *Supt.* Minneapolis, Minn.  
S. L. Beau, *M. M.* Brainerd, Minn.  
Dak. Div.: C. J. Wilson, *Supt.* Jamestown, Dak.  
F. N. Rlaten, *M. M.* Fargo, Dak.  
Manitoba Div.:  
W. Vanderville, *Supt.* Winnipeg, Manitoba.  
J. T. Ford, *M. M.* Winnipeg, Manitoba.  
Missouri and Yellow Stone Div.:  
F. E. Potter, *Act. Supt.* Glendive, Mont.  
M. M. .... Glendive, Mont.  
Montana Div.:  
H. J. Horn, *Supt.* Livingston, Mont.  
Angus Brown, *M. M.* Livingston, Mont.  
R. M. Div.: E. J. Pearson, *Supt.* Missoula, Mont.  
W. S. Clarkson, *M. M.* Missoula, Mont.  
Idaho Div.: F. W. Gilbert, *Supt.* Sprague, Wash.  
Wm. Moir, *M. M.* Sprague, Wash.  
Pac. Div.:  
Supt. .... Tacoma, Wash.  
H. H. Warner, *M. M.* Tacoma, Wash.  
North Pacific Coast R. R. 3 g. 94 m. 12 lo. 391 cars.  
J. B. Stetson, *G. M.* San Francisco, Cal.  
W. F. Russell, *Pur. Agt.* San Francisco, Cal.  
W. J. Thomas, *M. M. & C. B.* Sausalito, Cal.  
Northwestern Ohio Ry.  
North Galveston, Houston & Kansas City Ry.  
(See Galveston, La. Port & Houston Ry.)

## Ohio Central Lines:

Toledo & Ohio Central Ry. 4-8 1/2 g. 359 m. 80  
lo. 6,494 cars.  
Kanawha & Michigan Ry. 4-8 1/2 g. 168 m. 15 lo.  
600 cars.  
J. M. Ferris, *Gen. Man.* Toledo, O.  
H. A. Cooper, *Pur. Agt.* Toledo, O.  
J. B. Morgan, *M. M. & C. B.* Bucyrus, O.  
Ohio & Big Sandy R. R. (See C. & O. Ry. Co.)  
Ohio & Mississippi Ry. (See B. & O. Southwestern).  
4-9 g. 636 m. 124 lo. 3,823 cars.  
Ohio River R. R. 4-8 1/2 g. 223 m. 28 lo. 57 1/2 pas. & 1,543 ft. c.  
Geo. A. Burt, *P. & P. A.* Parkersburg, W. Va.  
A. H. Thorp, *P. A.* Parkersburg, W. Va.  
W. W. Layman, *M. M. & C. B.*  
Parkersburg, W. Va.  
Ohio River & Charleston Ry. 4-8 1/2 g. 212 1/4 m. 2  
Sam'l Hunt, *Pres. & G. M.* Cincinnati, O.  
T. D. Rhodes, *Pur. Agt.* Cincinnati, O.  
W. J. Wilcox, *M. M. & C. B.* Blacksburg, S. C.  
Ohio Southern R. R. 4-9 g. 225 m. 38 lo. 6,265 c.  
F. P. Grafman, ..... New York, N. Y.  
N. E. Matthews, *Rec. Mgr. Supt. & Pur. Agt.*  
Lima, O.  
H. M. Sehr, *M. M. & C. B.* Springfield, O.  
Old Colony R. R. 4-8 1/2 g. 603 m. 238 lo. 4,917 cars.  
(See N. Y., N. H. & H. C.)  
Omaha & St. Louis R. R. 4-8 1/2 g. 145 m. 17 lo. 450 c.  
J. M. Savin, *Gen. Man.* Quincy, Ill.  
John B. Voorhes, *M. M.* Stanberry, Mo.  
Oregon & Calif. S. Southern Pac. Co.  
Oregon Improvement Co., owning and operating  
Columbia & Puget Sound R. R., Pacific Coast  
Ry., Seattle & Northern Ry. and Port Town-  
send Southern R. R.  
3 and 4-8 1/2 g. 200 m. 20 lo. 492 cars.  
C. J. Smith, *Gen. Man. & Rec.* Seattle, Wash.  
W. E. Nichols, *Pur. Agt.* Seattle, Wash.

D. O'Leary, *M. M. & C. B.* Seattle, Wash.  
Oregon Central & Eastern R. R.  
4-8 1/2 g. 143 m. 15 lo. 332 cars.  
Edwin Stone, *Gen. Man.* Corvallis, Ore.  
C. Sullivan, *Supt. & Pur. Agt.* Corvallis, Ore.  
J. T. Welch, *M. M. & C. B.* Corvallis, Ore.  
Oregon R. R. & Nav. Co.  
4-8 1/2 g. 1,061 m. 110 l. 3,092 c.  
A. L. Mohler, *Pres. & Gen. Man.* Portland, Ore.  
F. G. Wheeler, *P. Agt.* Portland, Ore.  
J. F. Graham, *M. M. & C. B.* Portland, Ore.  
Oregon Short Line R. R. Co.  
3 and 4-8 1/2 g. 1,421.2 m. 126 lo. 4,904 c.  
W. H. Baneroff, *V. Pres. & Gen. Man.*  
Salt Lake City, Utah.  
I. O. Rhoades, *Pur. Agt.* Salt Lake City, Utah.  
J. F. Drum, *Supt. M. P.* Salt Lake City, Utah.  
W. P. Siddons, *M. C. B.* Salt Lake City, Utah.  
Ottawa & Gatineau Ry.  
4-8 1/2 g. 60 m. 4 lo. 50 cars.  
P. W. Rosseman, *Gen. Supt.* Ottawa, Ont.  
H. L. Maltby, *Pur. Agt.* Montreal, Que.  
Jas. Kav. *M. M. & C. B.* Aylmer, Que.  
P  
Pacific Coast Ry. Co. 3 ft. g. 76 m. 6 lo. 193 cars.  
E. W. Clark, *S. & Pur. A.* San Luis Obispo, Cal.  
Paducah, Tennessee & Alabama R. R. & Tenn. Mid-  
land Ry. 4-8 1/2 g. 255 m. 18 l. 585 cars.  
(See Nashville, Chattanooga & St. Louis Ry.)  
Panama R. R. 5 g. 48 m. 37 lo. 36 pas. 958 ft. c.  
Geo. Whaley, *Vice Pres. & Gen. Man.*  
New York, N. Y.  
G. Reynaud, *Pur. Agt.* New York, N. Y.  
D. G. Mott, *M. M.* Colon, Rep. Col.  
Pecos Val. Ry. & Pecos River R. R. 4-8 1/2 g. 164 m.  
6 lo. 320.  
E. O. Faulkner, *Rec. & G. M.* Eddy, N. M.  
G. F. Miller, *M. M.* Eddy, New Mex.  
Pennsylvania & North Western R. R.  
4-9 g. 73 m. 44 lo. 808 cars.  
F. S. Lewis, *Gen. Man. & Pur. Agt.* Phila., Pa.  
Geo. Van Brunt, *M. M.* Bellwood, Pa.  
A. Zimmerman, *M. C. B.* Bellwood, Pa.  
Pennsylvania Company operating  
Pitts., Fort Wayne & Chicago; Massillon & Cleve-  
land; So. Chi. & South; State Line & Indiana City; Pitts-  
burgh, Youngstown & Ashtabula; Cleve. & Pitts.;  
Erie & Pitts.; Newcastle & Bea. Val. and T. W. V.  
& O.; Pittsburgh, Ohio Valley & Cincinnati.  
4-9 g. 1,076 m. 508 lo. 41,169 cars.  
Gen. Divs. (1), (2), (3), (4) and (5).  
L. F. Loree, *Gen. Man.* Pittsburgh, Pa.  
H. O. Hukill, *Pur. Agt.* Columbus, O.  
Theo. N. Ely, *Chf. of M. P.* Philadelphia, Pa.  
Geo. L. Potter, *Supt. M. P.* Fort Wayne, Ind.  
(1) Erie Div.: 205 m.  
A. B. Starr, *Supt.* Allegheny City, Pa.  
W. F. Beardsley, *M. M.* Allegheny City, Pa.  
P. F. Smith, *Jr., M. M.* Crestline, O.  
(2) W'n Div.: 304 m., C. D. Law, *Supt.* Ft. Wayne, Ind.  
Bernard Fitzpatrick, *M. M.* Ft. Wayne, Ind.  
J. A. Graham, *For. Car Rep.* Ft. Wayne, Ind.  
(3) Erie & Ashtabula Div.: 224 m.  
H. W. Byers, *Supt.* Lawrence Junc., Pa.  
G. J. Parkin, *M. M.* Erie, Pa.  
(4) Cleveland & Pitts'g Div.: 217 m.  
W. H. Scriven, *Supt.* Cleveland, O.  
Geo. P. Sweeley, *M. M.* Wellsville, Ohio.  
(5) Toledo Div.: 126 m., W. H. Potter, *Supt.* Toledo, O.  
Pennsylvania R. R. Co.'s Roads. (7 Gen. Divs.)  
4-9 g. 4,095 m. 2,281 loco. 85,422 cars.  
J. B. Hutchinson, *Gen. Man.* Philadelphia, Pa.  
A. W. Sumner, *Pur. Agt.* Philadelphia, Pa.  
Samuel Forcher, *Act. Agt.* Philadelphia, Pa.  
F. D. Casanave, *Gen. S. M. P.* Altoona, Pa.  
(1) Pennsylvania R. R. Divs.  
Frank L. Sheppard, *Gen. Supt.* Altoona, Pa.  
W. W. Atterbury, *Supt. M. P.* Altoona, Pa.  
G. W. Stratton, *M. M.* Altoona, Pa.  
Jno. P. Levan, *Gen. For. C. S.* Altoona, Pa.  
Phila. Div.: Tho. Gucker, *Supt.* W. Phila., Pa.  
Richard Durbin, *Gen. For. C. S.* Phila., Pa.  
L. W. Van Houten, *Gen. For. C. S.* Phila., Pa.  
Schuylkill Div.:  
W. H. Meyers, *Supt.* Reading, Pa.  
Mid. Div.:  
Geo. W. Creighton, *Supt.* Harrisburg, Pa.  
G. L. Caum, *M. M.* Harrisburg, Pa.  
W. F. Eberle, *Gen. For. C. S.* Harrisburg, Pa.  
Altoona Div.: A. E. Reed, *Supt.* Altoona, Pa.  
Pitts. Div.: Robert Pitts, *Supt.* Pittsburgh, Pa.  
D. O. Shaver, *M. M.* Pittsburgh, Pa.  
W. Pa. Div.: D. M. Watt, *Supt.* Allegheny City,  
Pa. H. Falls, *Gen. For.* Blairsville, Pa.  
Fred. Div.: A. W. Moss, *Supt.* York, Pa.  
A. O. Baker, *M. M.* Columbia, Pa.  
Tyrone Div.: S. S. Blair, *Supt.* Tyrone, Pa.  
J. A. Beamer, *M. M.* Tyrone, Pa.  
Lew. Div.:  
Victor Wierman, *Supt.* Lewistown, Pa.  
C. S. Thomas, *M. M.* Lewistown, Pa.  
Ged. Div.: F. P. Abercrombie, S. Bedford, Pa.  
And. Green, *For. of Shon.* State Line, Pa.  
Monong. Div.: D. H. Lovell, *Supt.* Pittsburgh, Pa.  
Wm. Lininger, *Gen. Foreman* Pittsburgh, Pa.  
(2) United R. R. of N. J. Divs.  
F. Wolcott Jackson, *Gen. Supt.* Jersey City, N. J.  
H. S. Hayward, *Supt. & P.* Jersey City, N. J.  
H. Canfield, *M. M.* Hoboken, N. J.  
N. Y. Div.: W. Bannard, *Supt.* Jersey City, N. J.  
H. Canfield, *M. M.* Hoboken, N. J.  
J. W. Sanford, *M. M.* Meadows, N. Y.  
Belv. Div.: A. P. Gest, *Supt.* Lambertville, N. J.  
R. McDowell, *M. M.* Lambertville, N. J.  
Amboy Div.: W. Brown, *Supt.* Camden, N. J.  
Thos. Kerr, *M. M.* So. Amboy, N. J.  
R. Hill, *M. M.* Camden, N. J.  
W. McAllister, *M. M.* Camden, N. J.  
P. S. Bovart, *Gen. For.* So. Amboy, N. J.  
(3) West Jersey & Seashore R. R.  
A. O. Dayton, *Gen. Supt.* Camden, N. J.  
(4) Phila., Wilm. & Balt. R. R.  
H. F. Kenney, *Gen. Supt.* Philadelphia, Pa.  
Clarence Mendenhall, *S. M. P.* Philadelphia, Pa.

C. G. Turner, *M. M.* Wilmington, Del.  
(5) Phila. & Erie R. R. Divs.:  
J. M. Wallis, *Gen. Supt.* Williamsport, Pa.  
Edw. D. Nelson, *Supt. Mo. Po.* Williamsport, Pa.  
Northern Central Ry.  
J. M. Wallis, *Gen. Supt.* Williamsport, Pa.  
Edw. D. Nelson, *Supt. M. P.* Williamsport, Pa.  
J. M. Coale, *M. M.* Baltimore, Md.  
G. W. Demarest, *Gen. For.* Baltimore, Md.  
E'm. & Can. Divs.: S. Meade, *Supt.* Elmira, N. Y.  
Jas. Strode, *M. M.* Elmira, N. Y.  
J. C. Dyott, *Gen. For.* Elmira, N. Y.  
Pennacola, Ala. & Tenn. Ry. 4-6 g. 28 m. 4 lo. 130 c.  
C. H. Diahman, *P. G. M., G. S., P. A., M. M.*  
& M. C. B. .... Pennacola, Fla.  
Peoria & Pekin Union Ry. 4-8 1/2 g. 63 m. 19 lo. 250 c.  
F. L. Tompkins, *Supt. & P. Agt.* Peoria, Ill.  
Jas. W. Hill, *M. M. & C. B.* Peoria, Ill.  
Peoria, Decatur & Evansville Ry.  
4-8 1/2 g. 313 m. 33 lo. 1,803 cars.  
E. O. Hopkins, *Gen. Man. & Rec.* Evansville, Ind.  
W. J. Lewis, *Pur. Agt.* Evansville, Ind.  
C. C. Robinson, *M. M.* Mattson, Ill.  
J. E. Youts, *M. C. B.* Peoria, Ill.  
Phila. & Erie R. R. (See Penna. R. R. (5) Div.)  
Phila. Harrisb. & Pittsb. R. R. (See Phila. & Read. R. R.)  
Philadelphia & Reading Ry.  
4-8 1/2 g. 1,158 m. 734 lo. 23,581 cars.  
Theodore Voorhes, *1st V. P.* Philadelphia, Pa.  
J. D. Landis, *Pur. Agt.* Philadelphia, Pa.  
L. B. Paxson, *Supt. M. P. & R. E.* Reading, Pa.  
E. E. Davis, *A. S. M. P. & R. E.* Reading, Pa.  
W. T. Gorrell, *M. C. B.* Reading, Pa.  
I. A. Sweigard, *G. Supt.* Philadelphia, Pa.  
Phila., Reading & New England R. R.  
4-8 1/2 g. 181 m. 37 l. 607 cars.  
Jas. K. O. Sherwood, *Rec.* New York, N. Y.  
W. J. Martin, *G. S. & Pur. A.* Hartford, Conn.  
H. Schaefer, *M. M. & C. B.* Hartford, Conn.  
Phila., Newtown & New York R. R. 4-8 1/2 g. 23 m.  
Edward O. Tomlinson, *Supt.* Philadelphia, Pa.  
Howard Boyd, *Pur. Agt.* Norristown, Pa.  
Phila., Wilmington & Balt. R. R. (See Penna. R. R.)  
Piedmont Air Line (See Rich. & Danville)  
Pine Bluff & Eastern R. R. Co. 3 ft. g. 22 m. 2 lo. 20 c.  
S. W. Fordyce, *Receiver.* St. Louis, Mo.  
H. E. Martin, *Pur. Agt.* Pine Bluff, Ark.  
W. H. Hall, *M. M.* Pine Bluff, Ark.  
Pittsburgh, Akron & Western R. R.  
(See Northern Ohio Ry.)  
Pittsburgh, Bessemer & Lake Erie, R. R.  
4-8 1/2 g. 182 m. 31 lo. 2,117 cars.  
J. T. O'Dell, *Vice-Pres.* Pittsburgh, Pa.  
J. M. Ritchie, *Pur. Agt.* Pittsburgh, Pa.  
E. B. Gilbert, *M. M.* Greenville, Pa.  
Pittsburgh, Brady's Bend & Lake Erie R. R.  
Jos. Pool, *Pres.* New York, N. Y.  
Harwood R. Pool, *Sec'y.* New York, N. Y.  
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In course of construction.  
Pitts. & Castle Shannon R. R. 3-4 g. 8 1/2 m. 4 lo. 355 c.  
E. J. Reamer, *Supt. & Pur. Agt.* Pittsburgh, Pa.  
Holmes Ward, *M. M.* Castle Shannon, Pa.  
W. E. Long, *M. C. B.* Pittsburgh, Pa.  
Pitts. & Lake Erie R. R. and lessees of Pitts., McK. &  
Young R. R. 4-8 1/2 g. 438 m. 117 lo. 5,835 c.  
G. M. Beach, *Gen. Supt.* Pittsburgh, Pa.  
R. Evans, *Pur. Agt.* Pittsburgh, Pa.  
L. H. Turner, *Supt. M. P. & E.* Pittsburgh, Pa.  
Pitts. & West. Ry.: 3 & 4-8 1/2 g. 368 m. 115 lo. 5,712 c.  
Thos. M. King, *Pres. & Rec.* Allegheny, Pa.  
R. Finney, *Jr., Pur. Agt.* Allegheny, Pa.  
Frank T. Hyndman, *M. M.* Allegheny, Pa.  
Thos. Anderson, *M. C. B.* Allegheny, Pa.  
Pittsburgh, Chartiers & Youghiogheny Ry.  
4-8 1/2 g. 17 m. 7 lo. 80 c.  
J. B. Safford, *Supt. & Pur. Agt.*  
McKee's Rocks, Pa.  
Pittsburgh, Bradford & Buffalo Ry. (See Pitts. & West.)  
Pittsburgh, Cincinnati, Chicago & St. Louis Ry.  
4-9 g. 1,638.74 m. 508 lo. 40,067 cars.  
J. T. Brooks, *2d V. Pres.* Pittsburgh, Pa.  
L. F. Loree, *Gen. Man.* Pittsburgh, Pa.  
H. O. Hukill, *Pur. Agt.* Pittsburgh, Pa.  
S. P. Bush, *Supt. M. M.* Columbus, O.  
B. Fitzpatrick, *M. M.* Columbus, O.  
J. B. Swann, *For. C. S.* Columbus, O.  
Pitts. Div.: G. L. Peck, *Supt.* Pittsburgh, Pa.  
Michael Dunn, *M. M.* Dennison, O.  
J. B. Swann, *For. C. S.* Dennison, O.  
Ind. Div.: F. G. Darlington, *Supt.* Indianapolis, Ind.  
Wm. Swanson, *M. M.* Indianapolis, Ind.  
P. H. McGraw, *For. C. R.* Indianapolis, Ind.  
Chic. Div.: C. H. Walton, *Supt.* Logansport, Ind.  
W. C. Pennock, *M. M.* Logansport, Ind.  
J. Hannon, *For. C. S.* Logansport, Ind.  
Indianapolis & Vincennes R. R.  
M. W. Mansfield, *Supt.* Indianapolis, Ind.  
Jas. Landers, *Road For. Eng.* Indianapolis, Ind.  
Pittsburgh, Ft. Wayne & Chicago Ry. (See Penna. Co.)  
Pittsburgh, McK. & Yough. (See P. & L. E.)  
Pittsburgh, Shenango & Lake Erie Ry.  
(See Pittsburgh, Bessemer & Lake Erie R. R.)  
Pittsburgh, Youngstown & Ashtabula (See Penn. Co.)  
The Plant System, operating the Savannah, Florida  
& Western Ry.  
4-9 g. 1,944 m. 235 lo. 5,206 cars.  
Bradford Durham, *G. Supt.* Savannah, Ga.  
M. F. Loughman, *Pur. Agt.* New York, N. Y.  
G. M. D. Riley, *Supt. M. P.* Savannah, Ga.  
T. M. McDonough, *M. M.* Thomasville, Ga.  
Florida South'n R. R. Co. 4-9 g. 306 m. 32 lo. 663 c.  
H. A. Ford, *Supt.* Sanford, Fla.  
W. H. Young, *M. M.* Sanford, Fla.  
Charleston & Savannah Ry.  
4-8 1/2 g. 120 m. 23 lo. 751 cars.  
C. S. Gadsden, *Supt.* Charleston, S. C.  
D. B. Overton, *M. M.* Savannah, Ga.  
Alabama Midland Ry.  
4-8 1/2 g. 208 m. 18 lo. 450 cars.  
H. A. Ford, *Supt.* Sanford, Fla.  
W. J. McLean, *M. M.* Montgomery, Ala.  
Brunswick & Western.  
4-9 g. 170 m. 23 lo. 501 cars.  
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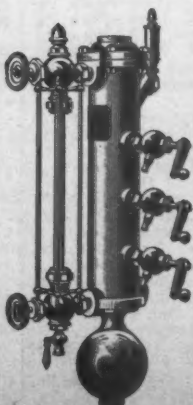
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Silver Springs, Ocala & Gulf Ry.

4-8 1/2 g. 80 m. 4 to 12 c.

G. W. Haines, Supt. . . . . Waycross, Ga.

M. M. . . . . High Springs, Fla.

Pontiac, Oxford &amp; Northern R. R.

4-8 1/2 g. 100 m. 6 to 12 c.

Wm. C. Sanford, G. S. &amp; P. A. Pontiac, Mich.

F. H. Neward, M. M. &amp; M. C. B. Pontiac, Mich.

Pontiac Pacific Junc. Ry. 4-8 1/2 g. 70 m. 4 to 6 c.

W. D. Harris, M. M. Dir. . . . . Ottawa, Ont.

H. L. Malby, P. A. . . . . Montreal, Can.

Jas. Kay, M. M. &amp; M. C. B. . . . . Aylmer, Que.

Port Royal &amp; Augusta Ry.

(See Charleston &amp; Western Carolina Ry.)

Port Royal &amp; Western Carolina Ry.

(See Charleston &amp; Western Carolina Ry.)

Portland &amp; Rochester R. R. 4-8 1/2 g. 55 m. 13 to 24 c.

J. W. Peters, Supt. &amp; Pur. Agt. . . . . Portland, Me.

E. H. C. Tompson, M. M. &amp; M. C. B. Portland, Me.

Portland &amp; Rumford Falls Ry.

4-8 1/2 g. 57 m. 10 to 11 c.

W. Pettengill, V. P. &amp; P. A. Rumford Falls, Me.

E. L. Lovejoy, Supt. . . . . Rumford Falls, Me.

M. R. Davis, M. M. . . . . Rumford Falls, Me.

Port Jervis, Monticello &amp; New York R. R.

4-8 1/2 g. 41.5 m. 3 to 22 c.

F. H. Reed, Gen. Man. . . . . Port Jervis, N. Y.

M. B. Waller, G. S. &amp; Pur. Agt. Port Jervis, N. Y.

Port Townsend Southern R. R.

(See Oregon Improvement Co.)

Potomac, Fred. &amp; Pied. R. R. 3 g. 38 m. 2 to 37 c.

W. H. Richards, G. M. &amp; P. A. Fredricksburg, Va.

W. P. Johnson, M. M. . . . . Fredericksburg, Va.

Poughkeepsie &amp; Eastern Ry.

4-8 1/2 g. 42 m. 3 to 67 c.

E. C. Osborn, Gen. Man. . . . . Poughkeepsie, N. Y.

Powellton &amp; Pocahontas R. R.

4-8 1/2 g. 9 m. 2 to 36 c.

E. Powell, Pres. . . . . Powellton, W. Va.

A. T. Massey, Pur. Agt. . . . . Powellton, W. Va.

W. T. Layton, M. M. . . . . Powellton, W. Va.

W. S. Miller, M. C. B. . . . . Powellton, W. Va.

Prince Edward Island Ry. (See Intercolonial Ry.)

Profile &amp; Franconia Notch R. R.

(See Concord &amp; Montreal R. R.)

Prov. &amp; Springfield R. R. Leased to N. Y. &amp; N. E. R. R.

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S. W. Bretzfeld, East'n Pur. Agt. . . . . New York, N. Y.

Arthur M. Parent, Asst. Man. Pullman Works,

Pullman, Ill.

H. M. Pfleger, Chief Mech Insp. Chicago, Ill.

Q

Quebec &amp; Lake St. John Ry. 4-8 1/2 g. 280 m. 15 to 320 c.

J. G. Scott, Sec. &amp; Manager . . . . . Quebec, Can.

A. Vallerand, Fur. Agt. . . . . Quebec, P. Q.

Jno. Campbell, M. M. &amp; M. C. B. Quebec, P. Q.

Quebec Central Ry. 4-8 1/2 g. 213 m. 15 to 561 cars.

Frank Grundy, Gen. Man. . . . . Sherbrooke, P. Q.

A. H. Anderson, P. A. . . . . Sherbrooke, P. Q.

Jas. Selveright, M. M. &amp; M. C. B. Sherbrooke, P. Q.

Quincy, Omaha &amp; Kan. City Ry.

(See Omaha, Kansas City &amp; Eastern R. R.)

R

Raritan River R. R. 4-8 1/2 g. 16 m. 3 to 33 c.

F. H. Earle, Pres. &amp; G. M. Jersey City, N. J.

F. Hoffman, Supt. . . . . South Amboy, N. J.

C. H. Slisson, P. A. . . . . Jersey City, N. J.

Raleigh &amp; Western Ry. Co.

4-9 g. 29 m. 1 to 150 cars.

S. A. Henszey, G. M. &amp; P. A. . . . . Egypt, N. C.

Richmond &amp; Danville R. R. Co. (See Southern Ry.)

Richmond &amp; Petersburg R. R. (See Atl. Coast Line.)

Richmond, Fredericksburg &amp; Potomac R. R.

4-8 1/2 g. 89 m. 25 to 180 cars.

E. T. D. Myers, P. &amp; G. S. . . . . Richmond, Va.

T. L. Courtney, Fur. Agt. . . . . Richmond, Va.

J. T. Bryant, M. M. . . . . Richmond, Va.

Z. L. Trainham, M. C. B. . . . . Richmond, Va.

Richmond, Nicholasville, Irvine &amp; Beattyville R. R.

4-8 1/2 g. 31 m. 4 to 28 cars.

John MacLeod, Rec. . . . . Louisville, Ky.

W. H. Adams, Supt. . . . . Richmond, Ky.

K. MacLeod, P. A. . . . . Louisville, Ky.

John Farrell, Gen. For. . . . . Richmond, Ky.

Rio Grande Western Ry.

4-8 1/2 g. 550 m. 74 to 771 c.

D. C. Dodge, Gen. Man. . . . . Denver, Colo.

A. E. Welby, G. S. &amp; P. A. Salt Lake City, Utah.

John Hickey, M. M. . . . . Salt Lake City, Utah.

Rio Grande Southern R. R. 3 g. 180 m. 35 to 326 c.

(See Denver &amp; Rio Grande R. R.)

Rock Island &amp; Peoria Ry. 4-8 1/2 g. 118 m. 18 to 570 c.

H. S. Cable, V. P. &amp; Pur. Agt. . . . . Rock Island, Ill.

H. P. Greenough, Supt. &amp; P. A. Rock Island, Ill.

Joseph Elder, M. M. &amp; M. C. B. . . . . Peoria, Ill.

Rome Watertown &amp; Ogdensburg R. R. N. Y. C. &amp;

H. R. R. Leese, 4-8 1/2 g. 642 m. 111 to 4,900 c.

Rutland R. R. 4-8 1/2 g. 136 m. 30 to 920 cars.

Clark L. Pierce, Gen. Supt. . . . . Rutland, Vt.

Henry G. Smith, Pur. Agt. . . . . Rutland, Vt.

Geo. W. Kenney, M. M. &amp; M. C. B. Rutland, Vt.

S

Sabine &amp; East Texas Ry. (See So. Pac.)

Saginaw, Tuscola &amp; Huron R. R.

4-8 1/2 g. 67 m. 9 to 192 c.

Wm. L. Webber, Pres., G. M. &amp; P. A.,

Saginaw, Mich.

Wm. L. Kerr, M. M. &amp; M. C. B. Saginaw, Mich.

Saginaw Valley &amp; St. Louis R. R. (Det. Lan. &amp; North'n.)

St. Augustine &amp; South Beach Ry. 3 g. 5 m. 2 to 2 c.

H. J. Ritchie, P. &amp; G. M. St. Augustine, Fla.

G. H. Bruner, Pur. Agt. . . . . St. Augustine, Fla.

St. Johns &amp; Lake Eustis Ry. (See Plant System.)

St. Johnsbury &amp; Lake Champlain R. R.

4-8 1/2 g. 132 m. 18 to 340 cars.

H. K. Folsom, Supt. . . . . Lyndonville, Vt.

J. A. Farrington, Pur. Agt. . . . . Boston, Mass.

Henry Bartlett, Supt. M. P. .... Boston, Mass.  
 J. T. Chamberlain, M. C. B. .... Boston, Mass.  
 St. Joseph & Grand Island R. R.  
 4-8 1/4 g. 445 m. 36 lo. 1,456 cars.  
 W. P. Robinson, Jr., Gen. Man. St. Joseph, Mo.  
 G. D. Berry, Pur. Agt. .... St. Joseph, Mo.  
 A. C. Hinkley, M. M. .... St. Joseph, Mo.  
 St. Louis, Cape Girardeau & Ft. Smith Ry.  
 4-8 1/4 g. 94 m. 91 lo. 121 cars.  
 Louis H. Ack, Gen. Man. & Pur. Agt.,  
 Cape Girardeau, Mo.  
 A. W. Quackenbush, Supt. of M. & M. C. B.,  
 Cape Girardeau, Mo.  
 St. Louis & Hannibal Ry. 4 1/4 g. 103 m. 7 lo. 145 c.  
 J. A. Jordan, Gen. Man. & P. A. Hannibal, Mo.  
 S. Rallins, Gen. For. .... Hannibal, Mo.  
 St. Louis & San Francisco Ry.  
 4-8 1/4 g. 1,372 m. 200 lo. 5,656 cars.  
 B. F. Yoakum, Gen. Man. & Pur. Agt.,  
 St. Louis, Mo.  
 J. R. Groves, Supt. of Machy. Springfield, Mo.  
 St. Louis, Alton & Springfield R. R. (See St. L., C.  
 & St. P. Ry.)  
 St. Louis, Alton & Terre Haute R. R.  
 (See Ill. Cent. R. R.)  
 St. Louis, Chicago & St. P. Ry. Co. of Illinois.  
 4-8 1/4 g. 111 m. 13 lo. 2,421 cars.  
 Chas. E. Kimball, Pres. .... New York, N. Y.  
 Henry W. Gays, Gen. Man. Springfield, Ill.  
 C. Millard, Supt. .... Springfield, Ill.  
 M. M. & M. C. B., Jerseyville, Ill.  
 St. Louis, Peoria & Northern Ry.  
 4-8 1/4 g. 102 m. 10 lo. 869 c.  
 Wm. E. Guy, G. M. & P. A. .... St. Louis, Mo.  
 A. L. Moler, M. M. .... Springfield, Ill.  
 St. Louis Southwestern Railway Co.  
 4-8 1/4 g. 1,223 m. 136 lo. 98 pass. and 4,364 frt. c.  
 J. A. Edson, Gen. Supt. .... Tyler, Tex.  
 A. Gould, P. A. .... St. Louis, Mo.  
 R. M. Galbraith, Gen. M. M. Pine Bluff, Ark.  
 J. M. Scrogin, M. M. .... Tyler, Tex.  
 St. Louis, Iron Mt. & So'n Ry. (See Mo. Pac.; (4) Div.  
 St. Louis, Kan. City & Colorado R. R.  
 4-8 1/4 g. 60 m. 21 lo. 52 cars.  
 Adiel Sherwood, Receiver. .... St. Louis, Mo.  
 W. M. Mitchell, Man. .... St. Louis, Mo.  
 St. L. Keokuk & No. W'n. Ry. (See C., B. & Q.)  
 St. Paul & Duluth R. R. 4-8 1/4 g. 247 m. 64 lo. 2,371 c.  
 A. B. Plough, Gen. Man. .... St. Paul, Minn.  
 W. N. Schoff, Pur. Agt. .... St. Paul, Minn.  
 G. D. Brooke, M. M. & M. C. B. .... St. Paul, Minn.  
 Salisbury & Harvey Ry. 4-8 1/4 g. 45 m. 2 lo. 35 c.  
 A. Sherwood, G. M. & P. A. .... Hillsboro, N. B.  
 T. Beck, M. C. B. .... Hillsboro, N. B.  
 San Antonio & Aransas Pass Ry.  
 4-8 1/4 g. 687.4 m. 60 lo. 1,397 cars.  
 M. D. Monserrate, Gen. Man. San Antonio, Tex.  
 T. B. Palfrey, P. A. .... San Antonio, Tex.  
 G. W. Butcher, M. M. & M. C. B. San Antonio, Tex.  
 San Diego, Cuyamaca & Eastern Ry.  
 4-8 1/4 g. 25.37 m. 2 lo. 39 cars.  
 W. S. Waterman, G. M. G. S. & P. A.  
 San Diego, Cal.  
 Sandy River R. R. 2 g. 18 m. 4 lo. 35 cars.  
 Josiah Maxey, G. M. .... Gardiner, Me.  
 E. H. Winslow, Pur. Agt. .... Gardiner, Me.  
 F. Greenwood, M. M. .... Phillips, Me.  
 Sandusky & Columbus Short Line.  
 (See Col. S. & H. Ry. Co.)  
 Sanford & St. Petersburg R. R. (See Plant System)  
 San Francisco & No. Pac. Ry.  
 4-8 1/4 g. 165 m. 18 lo. 538 cars.  
 A. W. Foster, P. G. M. & P. A. San Francisco, Cal.  
 John Bonner, M. M. .... Tiburon, Cal.  
 J. P. Samuelson, M. C. B. .... Tiburon, Cal.  
 San Pete Valley R. R. 4-8 1/4 g. 51 m. 2 lo. 22 cars.  
 T. Bruback, Gen. Man. .... Salt Lake City, U. T.  
 S. T. Pearson, Pur. Agt. .... Manti, Ut.  
 Wm. Watson, M. M. .... Manti, Ut.  
 Santa Fe Southern Ry. 3 g. 40 m. 3 lo. 42 cars.  
 T. J. Helm, Gen. Man. .... Santa Fe, N. Mex.  
 Santa Fe, Prescott & Phoenix Ry. Co.  
 4-8 1/4 g. 197.6 m. 10 lo. 100 cars.  
 F. M. Murphy, Pres. & G. M. Chicago, Ill.  
 O. H. Jackson, M. M. .... Prescott, Ariz.  
 Sault Ste. Marie & North-eastern R. R. (See Chi.  
 St. P. Minn. & Ontario Ry.)  
 4-8 1/4 g. 28 m. 2 lo. 15 cars.  
 Savannah, Florida & W'n Ry. (See Plant System.)  
 Sav. Griffin & No. Ala. R. R. Op. by Central (Ga.)  
 Seaboard Air Line, operating  
 Seaboard & Roanoke, Roanoke & Tar River, Raleigh  
 & Gaston, Raleigh & Augusta Air Line, Carolina  
 Central, Durham & Northern and Georgia,  
 Carolina & Northern Railroads.  
 Seaboard Air Line. 4-8 1/4 g. 957 m. 130 lo. 3,083 c.  
 E. St. John, V. P. & G. Man. Portsmouth, Va.  
 O. D. Ball, Jr., G. Pur. A. .... Portsmouth, Va.  
 Geo. P. Johnson, Supt. Car Service,  
 Portsmouth, Va.  
 W. T. Reed, Supt. M. P. & M. Portsmouth, Va.  
 C. B. Royal, M. M. .... Portsmouth, Va.  
 D. M. King, M. M. .... Raleigh, N. C.  
 G. D. Harris, M. M. .... Abbeville, S. C.  
 Seaboard Ry. of Alabama. 3-6 g. 324 m. 5 lo. 48 c.  
 S. T. Prince, Rec. .... Mobile, Ala.  
 W. J. Best, G. M. .... New York, N. Y.  
 Seattle & International Ry. Co.  
 4-8 1/4 g. 165.53 m. 131 lo. 684 c.  
 J. H. Bryant, Pres. & G. M. Seattle, Wash.  
 Newman Kline, Supt. & P. A. Seattle, Wash.  
 Dan. O'Leary, M. M. & M. C. B. Seattle, Wash.  
 Seattle, Lake Shore & Eastern Ry. (See Northern  
 Pacific Co.)  
 Seattle & Northern Ry. (See Ore. Improvement Co.)  
 Sharpville R. R. 4-8 1/4 g. 23 m. 4 lo. 4 cars.  
 G. M. McIlvain, Receiver. .... Sharpville, Pa.  
 J. V. Patton, P. & Gen. Man. .... Pittsburgh, Pa.  
 S. K. Harris, Pur. Agt. .... Sharpville, Pa.  
 Jas. Glass, M. M. .... Sharpville, Pa.  
 Shepaug, Litchfield & Northern R. R.  
 4-8 1/4 g. 38 m. 4 lo. 43 cars.  
 C. H. Platt, Gen. Man. .... New Haven, Conn.  
 J. E. Martin, Supt. & Pur. A. Danbury, Conn.  
 A. J. Brughel, M. M. & M. C. B. Hawleyville, Ct.

Sherman, Shreveport & Southern Ry. Co.  
 4-8 1/4 g. 153 m. 8 lo. 161 cars.  
 K. M. Alvord, Supt. .... Greenville, Tex.  
 C. N. Stevens, Pur. Agt. .... St. Louis, Mo.  
 Jas. Long, M. M. & M. C. B. Greenville, Tex.  
 Suver Lake Ry. Co. 4-8 1/4 g. 7 m. 2 lo. 523 cars.  
 Harry Yates, Pres. & Gen. Man. Buffalo, N. Y.  
 Geo. L. Eaton, Pur. Agt. .... Rochester, N. Y.  
 Silver Springs, Ocala & Gulf R. R.  
 (See Plant System.)  
 Sioux City, O'Neill & Western Ry.  
 4-8 1/4 g. 129 m. 6 lo. 355 cars.  
 F. C. Hills, Rec. G. M. & Pur. Agt.  
 T. J. Roope, M. M. & M. C. B. Sioux City, Ia.  
 Sioux City & Northern R. R.  
 4-8 1/4 g. 97 m. 12 lo. 485 cars.  
 W. Hough, Receivers. .... Sioux City, Ia.  
 S. J. Beala, .... Sioux City, Ia.  
 G. W. Oakley, Pur. Agt. .... Sioux City, Ia.  
 T. Roope, M. M. .... Sioux City, Ia.  
 Sioux City & Pacific and 4-8 1/4 g. 107 m. 11 lo. 370 c.  
 Fremont, Elkhorn & Mo. Val. R. R.  
 3 and 4-8 1/4 g. 5,030.74 m. 1,010 lo. 4,052 cars.  
 Geo. F. Bidwell, Gen. Man. .... Omaha, Neb.  
 Chas. Hayward, Pur. Agt. .... Chicago, Ill.  
 S. A. Teal, M. M. .... Missouri Valley, Ia.  
 W. H. Ramseyer, M. C. B. Missouri Valley, Ia.  
 Skaneateles R. R. 4-8 1/4 g. 5 m. 2 lo. 4 cars.  
 J. McNamara, Man., Supt. & Pur. Agt.  
 Skaneateles, N. Y.  
 M. Fennell, M. M. .... Skaneateles, N. Y.  
 Somerset Ry. 4-8 1/4 g. 41 m. 6 lo. 54 cars.  
 W. M. Ayer, Supt. & Pur. Agt. .... Oakland, Me.  
 C. Crowell, M. M. .... Oakland, Me.  
 S. P. Mosher, M. C. B. .... Oakland, Me.  
 Sonora Ry. (See A., T. & Santa Fe R. R.)  
 South Atlantic & Ohio R. R. 4-9 g. 71 m. 9 lo. 305.  
 John C. Haskell, Rec. & Pres. Bristol, Tenn.  
 C. M. Ward, Gen. Man. .... Bristol, Tenn.  
 H. W. Taylor, Pur. Agt. .... Bristol, Tenn.  
 E. M. Roberts, Asst. Supt. & M. M. Bristol, Tenn.  
 South Carolina & Georgia R. R.  
 4-8 1/4 g. 246 m. 45 lo. 1,368 cars.  
 Jos. H. Sands, Gen. Man. .... Charleston, S. C.  
 Ed. Parsons, Pur. Agt. .... New York, N. Y.  
 J. H. Green, Supt. M. P. & M. Charleston, S. C.  
 Southern California Ry. (See A., T. & S. F. Ry.)  
 Southern Pacific Company and proprietary lines:  
 4-8 1/4 and 3 ft. g. 130 m. 3 ft. g. 6,626 m. 4-8 1/4 g.  
 980 lo. 25,164 cars.  
 J. Kruttschnitt, Gen. Man. San Francisco, Cal.  
 F. W. Mahi, Mech. Eng. .... Sacramento, Cal.  
 Atlantic System.  
 W. G. Van Vleet, Man. .... Houston, Tex.  
 J. J. Ryan, Supt. M. P. .... Houston, Tex.  
 C. Trumphy, Pur. Agt. .... New Orleans, La.  
 P. J. Maguire, M. C. B. .... Algiers, La.  
 J. R. Cade, G. For. Car Dept. Houston, Tex.  
 Pacific System.  
 J. A. Fillmore, Man. .... San Francisco, Cal.  
 R. P. Schwerin, M. P. A. & S. S. Francisco, Cal.  
 H. J. Small, Supt. M. P. .... Sacramento, Cal.  
 B. Welch, M. C. B. .... Sacramento, Cal.  
 H. Stillman, Eng. of Tests. Sacramento, Cal.  
 Western Div.  
 A. D. Wilder, Supt. .... Oakland Pier, Cal.  
 Wm. McKenzie, M. M. .... Oakland, Cal.  
 Sacramento Div.: J. B. Wright, Supt. Sacramento, Cal.  
 T. W. Heintzleman, M. M. Sacramento, Cal.  
 Salt Lake Div.: J. Alger, Supt. .... Ogden, Utah.  
 E. M. Luckett, M. M. .... Ogden, Utah.  
 San Joaquin Div.:  
 D. Burkhalter, Supt. .... Bakersfield, Cal.  
 R. E. French, M. M. .... Bakersfield, Cal.  
 Los Angeles Div.:  
 J. A. Muir, Supt. .... Los Angeles, Cal.  
 P. Sheedy, M. M. .... Los Angeles, Cal.  
 Coast Div.:  
 J. L. Fazer, Supt. .... San Francisco, Cal.  
 F. L. Bates, M. M. .... San Francisco, Cal.  
 Yuma and Tucson Div.:  
 E. Randolph, Supt. .... Tucson, Ariz.  
 L. S. Pratt, M. M. .... Tucson, Ariz.  
 Shasta Div.: J. S. Noble, Supt. .... Dunsmuir, Cal.  
 A. D. Kilborn, M. M. .... Dunsmuir, Cal.  
 Lines in Oregon:  
 H. Koehler, Man. .... Portland, Ore.  
 R. J. Small, Supt. M. P. .... Sacramento, Cal.  
 T. W. Younger, M. M. .... Portland, Ore.  
 B. Welch, M. C. B. .... Sacramento, Cal.  
 Southern Ry. Co.  
 4 ft. 9 in. g. and 3 ft. 4.798 m. 646 lo. 20,072 c.  
 Frank S. Gannon, 3d V. P. Pres. & Gen. Man.  
 Washington, D. C.  
 W. H. Green, Gen. Supt. .... Washington, D. C.  
 J. P. Minette, Pur. Agt. .... Washington, D. C.  
 W. H. Thomas, Supt. M. P. .... Washington, D. C.  
 Washington Division:  
 E. Ryder, Supt. .... Charlottesville, Va.  
 C. F. Thomas, M. M. .... Alexandria, Va.  
 Norfolk Division:  
 N. J. O'Brien, Supt. .... Greensboro, N. C.  
 W. H. Hudson, M. M. .... Spencer, N. C.  
 Charlotte Division:  
 W. H. Ryder, Supt. .... Charlotte, N. C.  
 W. H. Hudson, M. M. .... Spencer, N. C.  
 Atlanta Division:  
 W. A. Vaughan, Supt. .... Atlanta, Ga.  
 W. L. Tracy, M. M. .... Atlanta, Ga.  
 Birmingham Division:  
 Supt. .... Birmingham, Ala.  
 T. M. Feeley, M. M. .... Birmingham, Ala.  
 Richmond Division:  
 W. T. West, Supt. .... Richmond, Va.  
 W. H. Owens, M. M. .... Manchester, Va.  
 Asheville Division:  
 W. O. Sprigg, Supt. .... Asheville, N. C.  
 Columbia Division:  
 P. L. Welles, Supt. .... Columbia, S. C.  
 T. S. Inge, M. M. .... Columbia, S. C.  
 Macon Division:  
 W. R. Beaupre, Supt. .... Macon, Ga.  
 W. L. Tracy, M. M. .... Atlanta, Ga.  
 Anniston Division:  
 A. Gordon Jones, Supt. .... Selma, Ala.

J. T. Robinson, M. M. .... Selma, Ala.  
 Knoxville Division:  
 F. K. Huger, Supt. .... Knoxville, Tenn.  
 J. B. Michael, M. M. .... Knoxville, Tenn.  
 Louisville Division:  
 G. R. Loyall, Supt. .... Louisville, Ky.  
 J. B. Gannon, M. M. .... Louisville, Ky.  
 Supplemental to Southern Ry., Alabama Great  
 Southern Ry. 4-8 1/4 g. 310 m. 62 lo. 3,570 cars.  
 C. A. Wickersham, Supt. .... Birmingham, Ala.  
 Southwestern Ry. 3 g. 35 m. 4 lo. 55 cars.  
 L. E. Barker, S. & P. A. Green Cove Springs, Fla.  
 South Florida R. R. (See Plant System.)  
 South Jersey R. R. 4-8 1/4 g. 103 m. 11 lo. 33 cars.  
 Francis I. Gowen, Receiver. Philadelphia, Pa.  
 Chas. A. Beach, G. M. & P. A. Philadelphia, Pa.  
 Lou's McLaine, M. M. .... Camden, N. J.  
 Spokane Falls & Northern, Nelson & Ft. Shepard  
 and Red Mountain Rys.  
 4-8 1/4 g. 217 m. 12 lo. 269 cars.  
 Austin Corbin, 2d Gen. Man. Spokane, Wash.  
 O. D. Mott, Pur. Agt. .... Spokane, Wash.  
 C. H. Prescott, M. M. & M. C. B. Spokane, Wash.  
 Staten Island Rapid Transit R. R.  
 4-8 1/4 g. 30 m. 18 lo. 103 cars.  
 J. V. Smith, Gen. Man. .... New York.  
 W. H. Lewis, Pur. Agt. .... New York.  
 Thos. Tyrrell, M. M. .... Chittc, S. I.  
 Stewartstown R. R. 4-8 1/4 g. 7 m. 1 lo. 3 cars.  
 M. W. Bahn, Gen. Man. .... New Freedom, Pa.  
 W. H. Fulton, Supt. & P. A. Stewartstown, Pa.  
 Suffolk & Carolina Ry. 3-6 g. 39 m. 4 lo. 115 cars.  
 Geo. L. Barton, Gen. Man. & Pur. Agt.  
 Suffolk, Va.  
 Jas. H. Nurney, M. M. .... Suffolk, Va.  
 Owen K. Pinner, M. C. B. .... Suffolk, Va.  
 Sumpter Valley Ry.  
 3 g. 31 m. 4 lo. 125 cars.  
 David Eccles, Pres. & G. Man. Baker City, Ore.  
 C. W. Nibley, V. P. & Fur. A. Baker City, Ore.  
 Syracuse, Geneva & Corning. (See Fall B. Coal Co.)  
 Tennessee Midland Ry.: 4-8 1/4 g. 135 m. 7 lo. 187 c.  
 (See Paducah, Tenn. & Ala.)  
 Terminal R. R. Association of St. Louis.  
 4-8 1/4 g. 54 m. 26 lo. 54 cars.  
 E. P. Bryan, Gen. Man. .... St. Louis, Mo.  
 J. E. Williams, Jr., P. A. .... St. Louis, Mo.  
 H. M. Smith, M. M. .... St. Louis, Mo.  
 Terre Haute & Indianapolis R. R.  
 Vandalia Line.  
 4-9 g. 638 m. 147 lo. 6,043 cars.  
 V. T. Malott, Receiver. .... Indianapolis, Ind.  
 J. J. Turner, V. P. & Gen. Man. St. Louis, Mo.  
 C. R. Peddle, Pur. Agt. .... Indianapolis, Ind.  
 Wm. C. Arp, S. M. P. .... Terre Haute, Ind.  
 Texas Central Ry. 4-8 1/4 g. 187 m. 10 lo. 237 cars.  
 C. Hamilton, Gen. M. G. S. & P. A. Waco, Tex.  
 P. T. Mooney, M. M. & M. C. B.  
 Walnut Springs, Tex.  
 Texas, Louisiana & Eastern R. R.:  
 4-8 1/4 g. 30 m. 2 lo. 30 cars.  
 Samuel Lazarus, Gen. Man. .... Conroe, Tex.  
 W. C. Beach, S. P. A. M. M. & M. C. B.  
 Conroe, Tex.  
 Texas Midland Ry. 4-8 1/4 g. 125 m. 13 lo. 222 c.  
 E. H. H. Green, P. G. M. & Pur. A. Terrell, Tex.  
 B. Hanson, M. M. .... Terrell, Tex.  
 Texas & N. Orleans R. R. (See So. Pac.)  
 Texas & Pacific Ry. 4-8 1/4 g. 1,508 m. 195 lo. 4,574 c.  
 L. S. Thorne, Gen. Man. .... Dallas, Tex.  
 A. Gould, Pur. Agt. .... St. Louis, Mo.  
 J. W. Addis, S. M. P. .... Marshall, Tex.  
 W. D. Minton, M. C. B. .... Marshall, Tex.  
 Texas, Sabine Valley & Northwestern Ry.  
 4-8 1/4 g. 40 m. 3 lo. 28 cars.  
 G. M. Grigsby, Pres. & G. M. Longview, Tex.  
 R. B. Levy, Sr., Rec. .... Longview, Tex.  
 S. P. Spaulding, M. M. .... Longview, Tex.  
 Texas Trunk R. R. 4-8 1/4 g. 52 m. 2 lo. 68 cars.  
 Wm. Whyte, Rec., Supt. & P. A. Dallas, Tex.  
 C. H. Burns, M. M. .... Houston, Tex.  
 Jas. McGee, M. C. B. .... Houston, Tex.  
 Tionesta Valley R. R. 3 g. 62 m. 5 lo. 273 c.  
 Isaac Horton, Gen. Man. .... Sheffield, Pa.  
 Jerry Cray, G. S., M. M. & M. C. B.  
 Sheffield, Pa.  
 A. H. Bailey, Pur. Agt. .... Sheffield, Pa.  
 Toledo, Peoria & Western Ry.  
 4-8 1/4 g. 248 m. 38 lo. 1,412 c.  
 Ed. F. Leonard, President. .... Peoria, Ill.  
 B. Warren, Pur. Agt. M. M. & M. C. B.  
 Peoria, Ill.  
 Toledo, St. Louis & Kan. City R. R.  
 4-8 1/4 g. 451 m. 87 lo. 3,697 c.  
 R. B. F. Peirce, Rec. .... Indianapolis, Ind.  
 A. L. Mills, Gen. Supt. .... Toledo, O.  
 C. B. McVay, Pur. Agt. .... Toledo, O.  
 Frank J. Pease, Act. M. M. .... Frankfort, Ind.  
 Tuckerton R. R. 4-8 1/4 g. 29 m. 3 lo. 18 c.  
 John C. Price, Supt. .... Tuckerton, N. J.  
 U  
 Ulster & Delaware R. R.  
 37 m. 4-8 1/4 g. 24 m. 3 ft. g. 20 lo. 327 cars.  
 Edward Coykendall, G. Supt. & P. A.,  
 Rondout, N. Y.  
 A. W. Belcher, M. M. .... Rondout, N. Y.  
 John Brenn, For. Car Rep. .... Rondout, N. Y.  
 Union Pacific system (4 Gen. Divs.)  
 4-8 1/4 g. 4,400 m. (705 lo. 17,236 cars.  
 3 g. 39.5 m.)  
 S. H. H. Clark, Oliver W. Mink, E. I. Killey  
 Anderson, John W. Doane, Fred. R. Coudert,  
 Receivers. .... Omaha, Neb.  
 E. Dickinson, Gen. Man. .... Omaha, Neb.  
 J. W. Griffith, Pur. Agt. .... Omaha, Neb.  
 J. H. McConnell, Supt. M. P. & M. C. B. Omaha, Neb.  
 E. Buckingham, Supt. C. S. .... Omaha, Neb.  
 A. M. Collett, Gen. Fore. Car. Dept.  
 Omaha, Neb.  
 Neb. Div.:  
 P. J. Nichols, Gen. Supt. .... Omaha, Neb.  
 J. H. Manning, M. M. .... Omaha, Neb.  
 Wyo. Div.:  
 T. A. Davis, M. M. .... Ogden, Utha.

Utah Div.:  
Supt. .... Salt Lake City, Utah.  
M. M. .... Pocatello, Idaho.  
Col. Div.: W. A. Deuel, Gen. Supt., Denver, Col.  
Z. T. Sprigg, M. M. .... Denver, Col.  
J. W. Blackburn, For. Car Reps., Denver, Col.  
Idaho Div.: C. A. Boies, Supt., Pocatello, Id.  
Kan. Div.: J. O. Brinkerhoff, Supt. Kan. City, Mo.  
James Roberts, M. M. .... Armstrong, Kan.  
Union Pacific, Denver & Gulf Ry.  
4-8 1/2 and 3 ft. g. 982 m. 96 to 2,962 cars.  
Frank Trumbull, Rec. & Gen. Man.,  
Denver, Colo.  
T. F. Dunaway, Gen. Supt. & Pur. Agt.,  
Denver, Colo.  
M. F. Egan, Supt. M. P. .... Denver, Colo.  
W. E. Fowler, M. C. B. .... Denver, Colo.  
Union Tank Line Co. 7,100 cars.  
J. Howard Wright, Pur. Agt., New York, N.Y.  
C. A. Smith, M. C. B. .... New York, N.Y.  
Utah Central Ry.  
8 g. 64 m. 7 to 149 cars.  
Geo. D. Loomis, Rec. & Gen. Man.,  
Salt Lake City, Utah  
Chas. E. Stanton, G. M., Salt Lake City, Utah.  
F. E. Shafter, Pur. Agt., Salt Lake City, Utah.  
J. U. Bywater, M. M. & M. C. B. Salt Lake City, Utah.

Vicksburg & Meridian R.R. (See Queen & Crescent.)  
Virginia & Truckee R.R. 4-8 1/2 g. 52 m. 13 to 325 c.  
Hume Yerington, Gen. Man., Carson City, Nev.  
L. L. Elrod, Pur. Agt., Carson City, Nev.  
I. N. Fording, M. M. .... Carson City, Nev.  
C. A. Brulin, M. C. B. .... Carson City, Nev.

Wabash R.R. 4-8 1/2 g. 1,979 m. 415 to 12,747 c.  
Jos. Ramsey, Jr., V. P. & Gen. Man.,  
St. Louis, Mo.  
J. B. Barnes, Supt. M. P. & M. C. B., Springfield, Ill.  
M. M. Martin, Supt. C. D. .... Decatur, Ill.  
John Lange, M. C. B. .... Moberly, Mo.  
H. H. Wellman, Pur. Agt., St. Louis, Mo.  
G. B. McKee, M. M. .... Moberly, Mo.  
Wabash, Chester & Western R.R.  
4-8 1/2 g. 65 m. 41 to 115 c.  
C. B. Cole, Gen. Man., Chester, Ill.  
J. R. Hawkins, Gen. Supt. & Pur. Agt., Chester, Ill.  
Geo. Dwyer, M. M. .... Chester, Ill.  
Waco & Northwestern Ry.  
4-8 1/2 g. 54 m. 5 to 91 cars.  
Alfred Abeel, Rec., Waco, Tex.  
P. A. Gorman, G. M. & P. A. .... Waco, Tex.  
Wagner Palace Car Co.  
W. S. Webb, Pres., New York, N.Y.  
H. W. Webb, Vice-Pres., New York, N.Y.  
J. D. Taylor, Treas., New York, N.Y.  
J. A. Spoor, Gen. Man., Chicago, Ill.  
J. C. Yager, Gen. Supt., New York, N.Y.  
A. Benson, Manager Buff. Wks., Buffalo, N.Y.

Wailkill Valley.  
4-8 1/2 g. 38 m. 3 to 117 c.  
J. D. Layng, Gen. Man., New York, N.Y.  
A. Bourne, Pur. Agt., New York, N.Y.  
Wm. Buchanan, Supt. M. P. .... New York, N.Y.  
J. M. Boon, Asst. S. M. P., Frankfort, N.Y.  
Washington & Columbia River Ry. Co.  
4-8 1/2 g. 162 m. 7 to 67 cars.  
W. D. Tyler, Pres., Gen. Man. & Pur. Agt.,  
Walla-Walla, Wash.  
J. M. Winslow, S. M. P., Walla-Walla, Wash.  
John Evans, M. M. .... Walla-Walla, Wash.  
Washington Southern Ry. Co. 4-8 1/2 g. 70 m. 31 to 118 c.  
J. R. McDonald, G. M. & S., Seattle, Wash.  
A. Johnson, Pur. Agt., Shelton, Wash.  
M. M. & M. C. B., Shelton, Wash.  
Waynesburg & Washington R.R. 3 g. 29 m. 41 to 75 c.  
C. E. Bower, Gen. Supt., Waynesburg, Pa.  
H. O. Hukill, Pur. Agt., Pittsburgh, Pa.  
A. M. Kline, M. M. .... Waynesburg, Pa.  
Western Maryland R.R. 4-8 1/2 g. 292.62 m. 51 to 759 c.  
J. M. Hood, Fr. & Gen. Man., Baltimore, Md.  
H. M. Burgan, Pur. Agt., Baltimore, Md.  
David Holts, Mast. of Mach. Union Bridge, Md.  
D. E. Little, M. C. B., Union Bridge, Md.  
Balt. & Har'rb'g Div.: H. D. Scott, Spt., Hanover, Pa.  
H. S. Kelley, M. M. .... Hanover, Pa.  
Western New York & Pennsylvania Ry. Co.  
4-8 1/2 and 3 g. 635 m. 150 to 3,350 c.  
S. G. De Coursey, Pres., Philadelphia, Pa.  
Robert Bell, Gen. Supt., Buffalo, N.Y.  
J. H. Poole, Pur. Agt., Buffalo, N.Y.  
Allen Vail, M. M. & M. C. B., Buffalo, N.Y.  
Pitts. Div.: J. P. Heindell, Supt., Oil City, Pa.  
P. P. Folger, M. M. .... Oil City, Pa.  
Roch. Div.: C. T. Dabney, Supt., Buffalo, N.Y.  
John Magee, M. M. .... Olean, N.Y.

West Jersey & Seashore R.R.  
(See Penn. R.R.; (3) Div.)  
Western Ry. of Alabama and Atlanta & West Point  
R.R. 4-9 g. 225 m. 33 to 603 cars.  
Geo. C. Smith, Pres. & Gen. Man., Atlanta, Ga.  
P. T. Downs, Supt., Montgomery, Ala.  
Robert T. Pace, Pur. Agt., Atlanta, Ga.  
R. H. Johnson, M. M. .... Montgomery, Ala.  
West Shore R.R. (N. Y. C. & H. R. R. R. Lessee.)  
4-8 1/2 g. 480 m. 220 to 8,296 c.  
J. D. Layng, 3d V. P. & Gen. Man., New York, N.Y.  
A. Bourne, Pur. Agt., New York, N.Y.  
W. Buchanan, Supt. M. P. & R. S., New York, N.Y.  
P. E. Garrison, Asst. S. M. P. & R. S.,  
Frankfort, N.Y.

H. R. Div.: Jos. B. Stewart, Supt. Weehawken, N.J.  
J. Howard, M. M. .... New Durham, N.J.  
Buff. Div.: U. H. Ketchum, Supt., Syracuse, N.Y.  
M. M. .... Buffalo, N.Y.  
W. Va. Cent. & Pitts'burgh Ry. 4-8 1/2 g. 163 m. 32 to 1,809 c.  
C. L. Bretz, Gen. Man., Cumberland, Md.  
W. H. Bower, Asst. Gen. Man. & Pur. Agt.,  
Elkins, W. Va.

J. S. Turner, M. M. & M. C. B., Elkins, W. Va.  
W. Va. & Pittsburgh R.R. 4-8 1/2 g. 159.34 m. 17 to 555 c.  
A. H. Kunst, V. P., G. M. & Pur. Agt.,  
Weston, W. Va.  
E. A. Steele, M. M. .... Weston, W. Va.

White & Black River Valley Ry. 4-8 1/2 g. 64 m. 47 to 98 c.  
W. J. Thompson, Gen. Man. & P. A.,  
Little Rock, Ark.  
M. J. Redding, M. M. .... Brinkley, Ark.  
L. F. Bill, M. C. B. .... Brinkley, Ark.  
Wheeling & L. E. Ry. 4-8 1/2 g. 249 m. 70 to 5,876 c.  
M. T. Herrick, Receiver, Cleveland, O.  
Hobbs, Blickensderfer, Rec. & G. M., Toledo, O.  
F. C. Gates, Pur. Agt., Toledo, O.  
J. B. Braden, Supt. M. P. & Cars, Norwalk, O.  
Wichita & Western Ry. (Operated by A., T. &  
S. F. Ry.)  
The Higgins Ferry Co.; East St. Louis Connecting  
Ry.; St. Louis Transfer Ry.  
4-8 1/2 g. 47 m. 14 to 30 cars.  
G. L. Sands, Man., St. Louis, Mo.  
C. L. Leslie, Pur. Agt., St. Louis, Mo.  
S. M. Dolan, M. M. & M. C. B., E. St. Louis, Ill.  
Williamsport & North Br. R.R. 4-9 g. 45 m. 7 to 1,12 c.  
R. E. Evenson, Gen. Man. & Pur. Agt.,  
Hughesville, Pa.

Geo. Woodley, M. M. & M. C. B., Hughesville, Pa.  
Wilmington & No'n R. R. 4-8 1/2 g. 92.30 m. 29 to 410 c.  
Col. H. A. Du Pont, G. M., Wilmington, Del.  
A. G. McCausland, S. & Pur. A., Wilmington, Del.  
George Rommel, M. M. .... Wilmington, Del.  
Wilmington & Newbern R. R. (See Atlantic Coast  
Line).  
Winifrede R. R. 4-9 g. 10 m. 3 to 200 cars.  
R. B. Cassidy, G. S. & P. A., Winifrede, W. Va.  
C. P. Spafford, M. M. .... Winifrede, W. Va.  
J. A. Bratt, M. C. B. .... Winifrede, W. Va.  
Winona & Western Ry.  
4-8 1/2 g. 114 m. 7 to 305 cars.  
J. J. Mahoney, G. Supt. & P. A., Winona, Minn.  
John Mallar, M. M. & M. C. B., Winona, Minn.  
Wisconsin Central Lines.  
4-8 1/2 g. 932.03 m. 149 to 7,602 c.  
H. F. Whitcomb, Gen. Man., Milwaukee, Wis.  
Sumner J. Collins, Gen. Supt., Milwaukee, Wis.  
A. D. Albion, Pur. Agt., Milwaukee, Wis.  
Jas. McNaughton, S. M. P. & C. Waukesha, Wis.  
Wm. Cormack, M. C. B., Stevens Point, Wis.  
Wisconsin & Michigan R.R. 4-8 1/2 g. 69 m. 9 to 584 c.  
J. N. Faithorn, Gen. Man. & Pur. Agt.,  
Chicago, Ill.

Wood River Branch Ry. 4-8 1/2 g. 5.7 m. 2 to 3 cars  
L. M. Barber, S. P. A. & M. M., Hope Val., R. 1  
Wrightsville & Tennille R.R. Co. 4-9 g. 36 m. 4 to 29 c.  
G. W. Perkins, G. M., Supt. & P. A., Tennille, Ga.  
W. H. Shepherd, M. M. & M. C. B., Tennille, Ga.

York Southern R. R.  
37 m. 4-8 1/2 g. 4 m. 3 ft. g. 41 m. 6 to 90 cars.  
S. M. Mainfold, G. M. & Pur. Agt., York, Pa.  
G. M. Jacobs, M. M. & M. C. B., York, Pa.  
Toughigheny R. R. 4-9 g. 10 m. 2 to 874 cars.  
John F. Wolf, Supt., Irwin, Pa.  
T. F. Wolf, P. A., Irwin, Pa.  
Jno. Bricker, M. M. .... Irwin, Pa.  
J. W. Heintzelman, M. C. B., Irwin, Pa.  
W. H. C. Albertson, Supt. Car Dept.,  
Philadelphia, Pa.

Zanesville & Ohio River Ry. 4-8 1/2 g. 75 m. 7 to 1,580 c.  
J. H. Sutor, Rec. G. M. & P. A., Zanesville, O.  
J. Hope Sutor, Pur. Agt., Zanesville, O.  
Van Smith M. M. .... Zanesville, O.

White & Black River Valley Ry. 4-8 1/2 g. 64 m. 47 to 98 c.  
W. J. Thompson, Gen. Man. & P. A.,  
Little Rock, Ark.  
M. J. Redding, M. M. .... Brinkley, Ark.  
L. F. Bill, M. C. B. .... Brinkley, Ark.  
Wheeling & L. E. Ry. 4-8 1/2 g. 249 m. 70 to 5,876 c.  
M. T. Herrick, Receiver, Cleveland, O.  
Hobbs, Blickensderfer, Rec. & G. M., Toledo, O.  
F. C. Gates, Pur. Agt., Toledo, O.  
J. B. Braden, Supt. M. P. & Cars, Norwalk, O.  
Wichita & Western Ry. (Operated by A., T. &  
S. F. Ry.)  
The Higgins Ferry Co.; East St. Louis Connecting  
Ry.; St. Louis Transfer Ry.  
4-8 1/2 g. 47 m. 14 to 30 cars.  
G. L. Sands, Man., St. Louis, Mo.  
C. L. Leslie, Pur. Agt., St. Louis, Mo.  
S. M. Dolan, M. M. & M. C. B., E. St. Louis, Ill.  
Williamsport & North Br. R.R. 4-9 g. 45 m. 7 to 1,12 c.  
R. E. Evenson, Gen. Man. & Pur. Agt.,  
Hughesville, Pa.

Geo. Woodley, M. M. & M. C. B., Hughesville, Pa.  
Wilmington & No'n R. R. 4-8 1/2 g. 92.30 m. 29 to 410 c.  
Col. H. A. Du Pont, G. M., Wilmington, Del.  
A. G. McCausland, S. & Pur. A., Wilmington, Del.  
George Rommel, M. M. .... Wilmington, Del.  
Wilmington & Newbern R. R. (See Atlantic Coast  
Line).  
Winifrede R. R. 4-9 g. 10 m. 3 to 200 cars.  
R. B. Cassidy, G. S. & P. A., Winifrede, W. Va.  
C. P. Spafford, M. M. .... Winifrede, W. Va.  
J. A. Bratt, M. C. B. .... Winifrede, W. Va.  
Winona & Western Ry.  
4-8 1/2 g. 114 m. 7 to 305 cars.  
J. J. Mahoney, G. Supt. & P. A., Winona, Minn.  
John Mallar, M. M. & M. C. B., Winona, Minn.  
Wisconsin Central Lines.  
4-8 1/2 g. 932.03 m. 149 to 7,602 c.  
H. F. Whitcomb, Gen. Man., Milwaukee, Wis.  
Sumner J. Collins, Gen. Supt., Milwaukee, Wis.  
A. D. Albion, Pur. Agt., Milwaukee, Wis.  
Jas. McNaughton, S. M. P. & C. Waukesha, Wis.  
Wm. Cormack, M. C. B., Stevens Point, Wis.  
Wisconsin & Michigan R.R. 4-8 1/2 g. 69 m. 9 to 584 c.  
J. N. Faithorn, Gen. Man. & Pur. Agt.,  
Chicago, Ill.

Wood River Branch Ry. 4-8 1/2 g. 5.7 m. 2 to 3 cars  
L. M. Barber, S. P. A. & M. M., Hope Val., R. 1  
Wrightsville & Tennille R.R. Co. 4-9 g. 36 m. 4 to 29 c.  
G. W. Perkins, G. M., Supt. & P. A., Tennille, Ga.  
W. H. Shepherd, M. M. & M. C. B., Tennille, Ga.

York Southern R. R.  
37 m. 4-8 1/2 g. 4 m. 3 ft. g. 41 m. 6 to 90 cars.  
S. M. Mainfold, G. M. & Pur. Agt., York, Pa.  
G. M. Jacobs, M. M. & M. C. B., York, Pa.  
Toughigheny R. R. 4-9 g. 10 m. 2 to 874 cars.  
John F. Wolf, Supt., Irwin, Pa.  
T. F. Wolf, P. A., Irwin, Pa.  
Jno. Bricker, M. M. .... Irwin, Pa.  
J. W. Heintzelman, M. C. B., Irwin, Pa.  
W. H. C. Albertson, Supt. Car Dept.,  
Philadelphia, Pa.

Zanesville & Ohio River Ry. 4-8 1/2 g. 75 m. 7 to 1,580 c.  
J. H. Sutor, Rec. G. M. & P. A., Zanesville, O.  
J. Hope Sutor, Pur. Agt., Zanesville, O.  
Van Smith M. M. .... Zanesville, O.

White & Black River Valley Ry. 4-8 1/2 g. 64 m. 47 to 98 c.  
W. J. Thompson, Gen. Man. & P. A.,  
Little Rock, Ark.  
M. J. Redding, M. M. .... Brinkley, Ark.  
L. F. Bill, M. C. B. .... Brinkley, Ark.  
Wheeling & L. E. Ry. 4-8 1/2 g. 249 m. 70 to 5,876 c.  
M. T. Herrick, Receiver, Cleveland, O.  
Hobbs, Blickensderfer, Rec. & G. M., Toledo, O.  
F. C. Gates, Pur. Agt., Toledo, O.  
J. B. Braden, Supt. M. P. & Cars, Norwalk, O.  
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S. M. Dolan, M. M. & M. C. B., E. St. Louis, Ill.  
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Geo. Woodley, M. M. & M. C. B., Hughesville, Pa.  
Wilmington & No'n R. R. 4-8 1/2 g. 92.30 m. 29 to 410 c.  
Col. H. A. Du Pont, G. M., Wilmington, Del.  
A. G. McCausland, S. & Pur. A., Wilmington, Del.  
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R. B. Cassidy, G. S. & P. A., Winifrede, W. Va.  
C. P. Spafford, M. M. .... Winifrede, W. Va.  
J. A. Bratt, M. C. B. .... Winifrede, W. Va.  
Winona & Western Ry.  
4-8 1/2 g. 114 m. 7 to 305 cars.  
J. J. Mahoney, G. Supt. & P. A., Winona, Minn.  
John Mallar, M. M. & M. C. B., Winona, Minn.  
Wisconsin Central Lines.  
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H. F. Whitcomb, Gen. Man., Milwaukee, Wis.  
Sumner J. Collins, Gen. Supt., Milwaukee, Wis.  
A. D. Albion, Pur. Agt., Milwaukee, Wis.  
Jas. McNaughton, S. M. P. & C. Waukesha, Wis.  
Wm. Cormack, M. C. B., Stevens Point, Wis.  
Wisconsin & Michigan R.R. 4-8 1/2 g. 69 m. 9 to 584 c.  
J. N. Faithorn, Gen. Man. & Pur. Agt.,  
Chicago, Ill.

Wood River Branch Ry. 4-8 1/2 g. 5.7 m. 2 to 3 cars  
L. M. Barber, S. P. A. & M. M., Hope Val., R. 1  
Wrightsville & Tennille R.R. Co. 4-9 g. 36 m. 4 to 29 c.  
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W. H. C. Albertson, Supt. Car Dept.,  
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Zanesville & Ohio River Ry. 4-8 1/2 g. 75 m. 7 to 1,580 c.  
J. H. Sutor, Rec. G. M. & P. A., Zanesville, O.  
J. Hope Sutor, Pur. Agt., Zanesville, O.  
Van Smith M. M. .... Zanesville, O.

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M. J. Redding, M. M. .... Brinkley, Ark.  
L. F. Bill, M. C. B. .... Brinkley, Ark.  
Wheeling & L. E. Ry. 4-8 1/2 g. 249 m. 70 to 5,876 c.  
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C. L. Leslie, Pur. Agt., St. Louis, Mo.  
S. M. Dolan, M. M. & M. C. B., E. St. Louis, Ill.  
Williamsport & North Br. R.R. 4-9 g. 45 m. 7 to 1,12 c.  
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J. W. Heintzelman, M. C. B., Irwin, Pa.  
W. H. C. Albertson, Supt. Car Dept.,  
Philadelphia, Pa.

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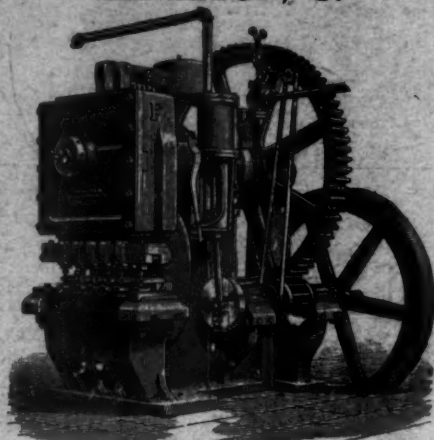
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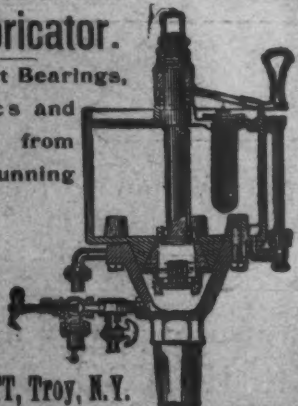
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